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THE INSTRUCTIONAL QUALITY INVENTORY: III. TRAINING WORKBOOK

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THE INSTRUCTIONAL QUALITY INVENTORY
III. TRAINING WORKBOOK

Patricia S. Fredericks

Reviewed by
John D. Ford. Jr.

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Released by
Donald F. Parker
Commanding Officer

Navy Personnel Research and Development Center
San Diego, California 92152

FOREWORD

The Instructional Quality Inventory (IQI) was developed in support of Navy Decision Coordinating Paper, Education and Training Development (NDCP-Z1175-PN), under subproject Z1175-PN.05, Improved Effectiveness in Course Design, Delivery, and Evaluation, and under the sponsorship of the Director of Naval Education and Training (OP-01). The overall objective of the subproject is to develop an empirically-based instructional design support system to aid developers in deciding on instructional alternatives based on cost/benefits and specified resource limitations. The purpose of the IQI is to provide quality control and/or evaluation procedures for instructional development.

This report is the third in a series of four on the IQI procedures. It provides a training workbook for the IQI process, and includes practice and annotated feedback of all IQI procedures. The other three reports are:

1. The Instructional Quality Inventory: Volume I, Introduction and Overview (NPRDC Special Report 79-3).
2. The Instructional Quality Inventory: Volume II, User's Manual, which provides a complete description of all IQI procedures and examples of their use (NPRDC Special Report 79-24).
3. The Instructional Quality Inventory: Volume IV, Job Performance Aid, which contains brief versions of the procedures contained in this volume (NPRDC Special Report 79-5).

Previous training manuals (NPRDC Special Report 77-14 and Technical Note 78-5) are superseded.

The IQI is intended for use by the Chief of Naval Education and Training; the Chief of Naval Technical Training; the Commander Training Command, Atlantic; the Commander Training Command, Pacific; and all other Navy activities concerned with the development, revision, or acquisition of instructional programs. Prospective users of the IQI are invited to contact this command for assistance in implementation.

Appreciation is extended to John A. Ellis and Wallace H. Wulfeck, II, for their review of the material and comments on the manual, to Lisa A. Graff who assisted in collecting examples for illustrating the IQI classifications, and to Barbara A. Morris for preparing and editing the workbook.

DONALD F. PARKER
Commanding Officer

JAMES J. REGAN
Technical Director

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INTRODUCTION

The Instructional Quality Inventory

The Instructional Quality Inventory (IQI) is a set of procedures for quality control of instructional development, designed to parallel and supplement the ISD process. The IQI procedures can also be used to evaluate existing instruction, and can be used as evaluation or acceptance tools for instructional programs obtained through contract.

There are four volumes in the IQI series:

1. Volume I (NPRDC Special Report 79-3) provides an introduction and overview of the IQI.
2. Volume II (NPRDC Special Report 79-24) includes a complete description of all IQI procedures, and gives examples of their use.
3. Volume III (this volume) provides additional practice and examples on the IQI procedures.
4. Volume IV (NPRDC Special Report 79-5) is a Job Performance Aid. It contains a brief version of each IQI procedure.

Volume I should be read prior to reading this volume. Also, each of the procedures from Volume IV is reproduced in this volume.

About this Manual:

This manual contains five chapters. Chapter 1 contains practice on classification that is necessary for the other chapters. Chapters 2 through 5 contain practice on the main IQI procedures. The chapters are as follows:

1. Classification. The IQI procedures are based on a system for classifying objectives, test items, and instructional components. Classification is determined according to (a) what the student is required to do with the information to be learned, and (b) what type of information the student is learning.
2. Objective Adequacy. Since good instruction depends on careful specification of learning objectives, the first IQI procedure is to assure the adequacy of objectives. This is done by classifying each objective, and judging whether or not it accurately reflects the intended student performance after training.

3. Test Consistency and Adequacy. The next IQI step is to make sure that tests accurately measure progress toward the objectives. This is done by assessing the consistency between each test item and its associated objective, and the adequacy of the item. Essentially, each test item must be classified in the same way as its objective and must be adequately constructed.
4. Presentation Consistency. Instructional presentations contain various components, including statements of material to be learned, examples, and practice. For consistency, different combinations of presentation components are required, depending on the classification of the objective.
5. Presentation Adequacy. The final IQI step is to make sure that each required presentation component is adequate according to psychological principles of learning.

Chapter Organization:

Each chapter contains:

1. A statement of the procedure discussed in that chapter.
2. Practice items for the procedure.
3. Feedback on the practice items.

For Chapters 2 through 5, each statement of the procedure is the same as in Volume IV.

A complete description of all IQI procedures and additional examples of their use are contained in Volume II.

Purpose of this Manual

This manual gives the instructional developer practice in applying the IQI procedures and should be used in conjunction with Volume II.

Chapter 1

CLASSIFICATION

Introduction

The IQI uses a classification scheme for objectives, test items, and components of instruction. This scheme was adopted because it allows consistency judgments to be made more precisely than if objectives and test items were left unclassified, and it allows judgments to be made about what the instruction should contain. The IQI classification scheme was designed so that different classifications of objectives and test items require different instructional strategies.

The IQI classification scheme is shown below. Classification is determined according to:

1. What the student must do; that is, the TASK to be performed,
2. The type of information the student must learn; that is, the instructional CONTENT.

	FACT	CATEGORY	PROCEDURE	RULE	PRINCIPLE
REMEMBER	RECALL OR RECOGNIZE NAMES, PARTS, DATES, PLACES, VOCABULARY DEFINITIONS, ETC.	REMEMBER THE CHARACTERISTICS OF EACH CATEGORY AND THE GUIDELINES FOR CLASSIFICATION.	REMEMBER THE STEPS OF THE PROCEDURE.	REMEMBER THE FORMULA OR THE STEPS OF THE RULE.	REMEMBER THE CAUSE AND EFFECT RELATIONSHIPS OR THE STATEMENT OF THE PRINCIPLE.
USE UNAIDED		CLASSIFY OR CATEGORIZE OBJECTS, EVENTS, IDEAS, ACCORDING TO THEIR CHARACTERISTICS, WITH NO MEMORY AID.	APPLY THE STEPS OF THE PROCEDURE IN A SINGLE SITUATION OR ON A SINGLE PIECE OF EQUIPMENT, WITH NO MEMORY AID.	APPLY THE FORMULA OR RULE TO A VARIETY OF PROBLEMS OR SITUATIONS, WITH NO MEMORY AID.	USE THE PRINCIPLE TO INTERPRET OR PREDICT WHY OR HOW THINGS HAPPENED OR WILL HAPPEN, WITH NO MEMORY AID.
USE AIDED		GIVEN CATEGORY CHARACTERISTICS AND GUIDELINES, CATEGORIZE OBJECTS, EVENTS, IDEAS, ACCORDING TO CHARACTERISTICS.	GIVEN STEPS OF THE PROCEDURE, APPLY THE PROCEDURE IN A SINGLE SITUATION, OR ON A SINGLE PIECE OF EQUIPMENT.	GIVEN THE FORMULA OR RULE STEPS, APPLY THE FORMULA OR RULE TO A VARIETY OF PROBLEMS OR SITUATIONS.	GIVEN A STATEMENT OF THE PRINCIPLE, INTERPRET OR PREDICT WHY OR HOW THINGS HAPPENED OR WILL HAPPEN.

Note: The classification table above is slightly different than the classification tables in Volumes I and IV. The word "concept" has been changed to "category" in the second column, because "concept" has too many other meanings and is confusing.

Procedure for Classification

Step 1. Determine the TASK LEVEL.

- a. Determine whether the student is to REMEMBER or USE information.
- b. If the student is to USE information, determine whether the task level is USE-AIDED or USE-UNAIDED.

Step 2. Determine the CONTENT TYPE.

- a. If the student must recall or recognize names, parts, locations, functions, dates, places, etc., then the content type is FACT.
 - b. If the student must remember characteristics of similar objects, events, or ideas, OR if the student must sort or classify objects, events, or ideas according to characteristics, then the content type is CATEGORY.
 - c. If the student must remember a sequence of steps which apply to a single situation, OR if the student must apply the steps to a single piece of equipment or a single situation, then the content type is PROCEDURE.
 - d. If the student must remember a sequence of steps and decisions which apply in a variety of situations, OR if the student must apply the sequence across a variety of situations or types of equipment, then the content type is RULE.
 - e. If the student must remember how or why things work the way they do, or cause-effect relationships, OR if the student must use his knowledge to explain how things work, or predict effects from causes, then the content type is PRINCIPLE.
-

CLASSIFICATION PRACTICE

In this section, sample objectives and sample test items are given for you to classify according to the scheme just presented. In the space provided you can give your reasons for the classification and state the questions you would ask a subject-matter expert to help you better understand "the job."

Some of the objectives and test items will be difficult to classify. There are three reasons for this. First, many of them are not "good" ones; they are written in such a way that it may not be clear what behavior is required or what content is to be taught. (They are, however, fairly typical.) Second, all of them are taken out of context and may deal with unfamiliar topics. Therefore, they are difficult to classify, because information about the job is not provided. Third, some examples were chosen deliberately to be hard to classify, so that classification problems could be illustrated.

For the reasons given above, the reader should not expect to be able to classify perfectly these objectives and test items (or any others) immediately. In fact, it is better not to attempt immediate classification. Instead, since the most important step in classification is REMEMBER THE JOB, the reader should learn to ask the "right" questions of job experts, so that bad objectives can be revised, and so that unfamiliar topic areas can be classified reliably.

When you finish classifying each item yourself, turn the page for the FEEDBACK on that item. Look at the reasons for the item's classification. Also, notice the kinds of questions asked about items that are not clear.

In this section we are concerned only with the classification of each example. In the next chapter we will deal with the adequacy of objectives.

1. OBJECTIVE: The student will solve for total power in a DC parallel circuit.

Task Level? _____

Content Type? _____

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1. OBJECTIVE: The student will solve for total power in a DC parallel circuit.

Task Level? USE-UNAIDED

*The task level is Use because the student must solve problems.
It is not aided because the formula for total power is not given.*

Content Type? RULE

The word "solve" is a keyword for Rule. Here the student must remember the formula for total power and then use it to solve problems.

2. Test Item: Destroy classified documents under routine conditions given the outline in OPNAVINST5510.1 and KAG-1.

Task Level? _____

Content Type? _____

2. Test Item: Destroy classified documents under routine conditions given the outline in OPNAVINST5510.1 and KAG-1.

Task Level? USE-AIDED

What does the student have to do? He must "destroy" classified documents. However, he is given references which outline the steps that must be performed to accomplish this. Therefore, the task level is use-aided.

Content Type? PROCEDURE

The student must follow a specific series of steps for destroying classified documents under routine conditions - one situation. This implies that there are other specific procedures for emergency conditions. You can check with a subject-matter expert to make sure.

3. Test Item: State the radar signal characteristics used in identifying circular, sector, conical & steady scans on an analysis scope.

Task Level? _____

Content Type? _____

3. Test Item: State the radar signal characteristics used in identifying circular, sector, conical and steady scans on an analysis scope.

Task Level? REMEMBER

The student is asked to state (recall) the characteristics of four different types of scans. At this time he is not asked to actually categorize a signal as a certain type of scan. Therefore, the task level is Remember.

Content Type? CATEGORY OR FACT

The key question here is "What is the JOB?" For later signal analysis, the student will probably have to classify radar signals according to types of scans.

The way this test item is written, it sounds as if the student is remembering characteristics so that he can later categorize. If, however, it turns out that the scans within each type are nearly identical, the content type would be Fact. One question you can ask is "If you've seen one, have you seen them all?" If the answer is yes, then the student is really dealing with several facts. If not, then the student is learning category characteristics so that scans he has never seen before can be classified. Again, a subject-matter expert can help you make this decision.

4. OBJECTIVE: The student will recall the proper sequence of steps for testing a transistor using a multimeter.

Task Level? _____

Content Type? _____

4. OBJECTIVE: The student will recall the proper sequence of steps for testing a transistor using a multimeter.

Task Level? REMEMBER

Does the student have to remember something or actually perform the task? In this case he must only recall the steps. He is not asked to use the multimeter while troubleshooting a transistor to see what's wrong with it.

Content Type? PROCEDURE OR RULE

If these steps are always the same regardless of the type of transistor and the type of multimeter, then the content type is Procedure. However, if this sequence of steps varies for different transistors or different multimeters, or if complicated decisions are involved in the sequence, then the content type is Rule.

5. Test Item: State Ohm's Law.

Task Level? _____

Content Type? _____

5. Test Item: State Ohm's Law.

Task Level? REMEMBER

"State" is a keyword for the Remember level. The student is not asked to use the information about Ohm's Law - only to Remember it.

Content Type? RULE OR PRINCIPLE

Ohm's Law is a formula that can be used to solve for an unknown ($I = \frac{E}{R}$). However, it is also a principle which can be used to predict what happens to current, voltage or resistance when two are varied. Which content type is meant here? Again it is important to remember the job. If the student will solve circuit problems using the formula, the content type is Rule. If the student must make predictions about circuit behavior under varying conditions, the content type is Principle.

6. Test Item: Troubleshoot a circuit in which no current is flowing.

Task Level? _____

Content Type? _____

6. Test Item: Troubleshoot a circuit in which no current is flowing.

Task Level?

USE-UNAIDED

The student is asked to perform a task. It is not just recalling something; he must remember how to troubleshoot a circuit and then do it. No aid is given.

Content Type?

PROCEDURE OR PRINCIPLE

There are two ways in which troubleshooting can be performed, and the content type of this test item depends on which way is desired.

If there is a simple series of steps or tests to be performed which is always performed in the same way, and which is guaranteed to locate any fault, then the content type is Procedure.

On the other hand, if the student must use his knowledge of electronic theory to make predictions about likely causes of trouble, and to determine what tests to perform, then the content type is Principle.

7. OBJECTIVE: Given the formula for capacitive reactance and the values of frequency and capacitance from a schematic, the student will calculate capacitive reactance.

Task Level? _____

Content Type? _____

7. **OBJECTIVE:** Given the formula for capacitive reactance and the values of frequency and capacitance from a schematic, the student will calculate capacitive reactance.

Task Level? USE-AIDED

What must the student do? He must "calculate" capacitive reactance given two values and the formula. In this case the formula is the memory aid. The task is use-aided.

Content Type? RULE

"Calculate" is another keyword for rule. Formulas and mathematical calculations are rules that can be applied to various situations and values.

8. OBJECTIVE: The student will classify materials as being separable or not separable from lube oil by the Sharples oil purifier.

Task Level? _____

Content Type? _____

8. OBJECTIVE: The student will classify materials as being separable or not separable from lube oil by the Sharples oil purifier.

Task Level? USE-UNAIDED OR REMEMBER

The task level of this test item depends on the complexity of the task. "Classify" is usually a key word at the use level for sorting many items into a few categories. However, in this case it turns out that there are only a few materials that are not separable and they can be easily remembered. The student will not have to use his knowledge of the characteristics to classify new materials. Therefore, this is a Remember level.

Content Type? FACT OR CATEGORY

Since there are only a few materials to remember, this objective can best be taught as a Fact. This fact will provide information necessary for operating the Sharples purifier.

9. TEST ITEM: Explain how hydraulic systems work.

Task Level? _____

Content Type? _____

9. Test Item: Explain how hydraulic systems work.

Task Level? REMEMBER OR USE-UNAIDED

It is not clear what is expected of the student. If the student is asked to explain from memory what he learned in the text about how hydraulic systems work, it is clearly Remember. However, if he must apply what he learned about certain principles of fluids in motion to predict how a certain system works, it is use-unaided.

Content Type? PRINCIPLES

This test item asks the student to explain how hydraulic systems work. The content type is Principle.

10. OBJECTIVE: The student will sort pictures of clouds into stacks by types, given labeled illustrations of identified cloud types.

Task Level? _____

Content Type? _____

10. OBJECTIVE: The student will sort pictures of clouds into stacks by types, given labeled illustrations of identified cloud types.

Task Level? USE-AIDED

This objective is an example of a pure "using" task. The illustrations of identified clouds are the aid. There is no need to remember the characteristics of each type cloud; they are given. The student is asked to categorize pictures of new examples of clouds based on the characteristics in the labeled clouds.

Content Type? CATEGORY

There are many variations in cloud formations. In order to label clouds the student must sort new examples according to their characteristics.

11. Test Item: Use your oscilloscope to calibrate the
10XMV -2817V test prod.

Task Level? _____

Content Type? _____

11. Test Item: Use your oscilloscope to calibrate the 10XX -2817V test prod.

Task Level? USE-UNAIDED

The student must perform the task. He must "calibrate" the test prod. He is not told how to do it; he must perform the job from memory. The task is use-unaided. The oscilloscope is a tool necessary to perform the task, but is not an aid because it does not tell him how to do the task.

Content Type? PROCEDURE

When you are calibrating a specific single piece of equipment there are usually steps that you must perform in a certain order each time you do the job. This is probably a Procedure.

12. OBJECTIVE: Given an incoming signal, the EW operator will identify it as being emitted from a particular type radar on a particular type of platform.

Task Level? _____

Content Type? _____

12. OBJECTIVE: Given an incoming signal, the EW operator will identify it as being emitted from a particular type radar on a particular type of platform.

Task Level? USE-UNAIDED

The student will analyze the incoming signal and "categorize" it according to specific characteristics. The task level is use. There is no memory aid, so the task is unaided.

Content Type? CATEGORY

From an analysis of the job, it turns out that there are many incoming signals which can be classified according to a small number of types of radars and platforms.

13. OBJECTIVE: Given diagrams that graphically represent how the steam cycle works, the student will use them to explain the operation of the auxiliary condensate system.

Task Level? _____

Content Type? _____

13. **OBJECTIVE:** Given diagrams that graphically represent how the steam cycle works, the student will use them to explain the operation of the auxiliary condensate system.

Task Level? USE-AIDED

What must the student do? The objective requires the student to use information about the steam cycle to explain how a new system works. The diagrams are given to "jog" the students' memory about how the basic steam cycle works. The objective is use-aided.

Content Type? PRINCIPLE

Principles involve explanations, analyses, or predictions about how things work the way they do.

Chapter 2

OBJECTIVE ADEQUACY

Introduction

Why are objectives used in instructional development? The reason is communication. Objectives communicate to everyone involved in an instructional program--managers, designers, writers, instructors, and the students themselves--what the program is meant to accomplish. Each objective should specify something the student must be able to do at the end of the course that he couldn't do at the beginning. If the objective does not communicate this clearly, or if it specifies something inappropriate for the intent of the instructional program, then it is not adequate.

For an objective to communicate clearly, it must contain three parts. First, it must specify the CONDITIONS under which the student is to perform. Second, it must specify what STANDARDS the performance must meet. Third, it must specify what the performance is; that is, what ACTION the student is to perform. These three parts are the minimum elements in a clearly stated objective; additional information might have to be provided to make the objective clear. Remember, the objective must communicate to test developers and to instructional developers. How could a test developer write an item if the standards were not known?

A good check on whether or not an objective is clear is to try to classify it according to the classification scheme in chapter 1. If an objective is hard to classify (if it is hard to decide which box it goes in), this means that the ACTION is unclear; we don't know exactly what the student must do.

An objective may be clear, but be inappropriate for the intent of the instructional program. In this case, the objective is still inadequate. To be appropriate, an objective must prepare the student for what he will be required to do or know following the instructional program. This following duty could be anything from job performance, to on-the-job training, to another formal follow-on school; these are all "jobs" after a training program. To determine appropriateness of an objective, the key is to "REMEMBER THE JOB."

On the next two pages, the OBJECTIVE ADEQUACY procedures from Volume I are reproduced. These procedures correspond to the criteria discussed above. For additional explanation about the procedures, refer to Volume II. Finally, you will apply the procedures to the practice examples.

OBJECTIVE ADEQUACY



INSTRUCTION
QUALITY
INVENTORY

STEP 1: ENTER the COURSE TITLE and OBJECTIVE NUMBER at the top of the form.

STEP 2: Determine whether or not the OBJECTIVE is CORRECTLY STATED.

CARD 1

2a: Are the CONDITIONS under which student performance is expected specified?

ENVIRONMENT: PHYSICAL (weather, time of day, lighting, etc.)
SOCIAL (isolation, individual, team, audience, etc.)
PSYCHOLOGICAL (fatigue, stress, relaxed, etc.)

INFORMATION: GIVEN INFORMATION (scenario, formula, values, etc.)
CUES (signals for starting or stopping)
SPECIAL INSTRUCTIONS

RESOURCES: JOB AIDS (cards, charts, graphs, checklists, etc.)
EQUIPMENT, TOOLS
TECHNICAL MANUALS

2b: Are the STANDARDS which the student performance must meet specified?

PERFORMANCE: COMPLETENESS (how much of the task must be performed)
ACCURACY (how well must each task be performed)
TIME LIMIT (how much time is allowed)
RATE (how fast must task be done)

PRODUCT: COMPLETENESS (what must finished product contain)
QUALITY (what objective standard must product meet)
JUDGEMENT (what subjective opinions must product satisfy)

2c: Is the ACTION the student must perform specified?

Is an action verb used to specify what the student must do?

Is only one action stated in the objective?

STEP 3: Determine whether or not the OBJECTIVE is CLASSIFIABLE? Does the OBJECTIVE fit in one and only one cell of the table below?

	FACT	CATEGORY	PROCEDURE	RULE	PRINCIPLE
REMEMBER	RECALL OR RECOGNIZE NAMES, PARTS, DATES, PLACES, VOCABULARY DEFINITIONS, ETC.	REMEMBER THE CHARACTERISTICS OF EACH CATEGORY AND THE GUIDELINES FOR CLASSIFICATION	REMEMBER THE STEPS OF THE PROCEDURE.	REMEMBER THE FORMULA OR THE STEPS OF THE RULE.	REMEMBER THE CAUSE AND EFFECT RELATIONSHIPS OR THE STATEMENT OF THE PRINCIPLE.
USE UNAIDED		CLASSIFY OR CATEGORIZE OBJECTS, EVENTS, IDEAS, ACCORDING TO THEIR CHARACTERISTICS, WITH NO MEMORY AID.	APPLY THE STEPS OF THE PROCEDURE IN A SINGLE SITUATION OR ON A SINGLE PIECE OF EQUIPMENT, WITH NO MEMORY AID.	APPLY THE FORMULA OR RULE TO A VARIETY OF PROBLEMS OR SITUATIONS, WITH NO MEMORY AID.	USE THE PRINCIPLE TO INTERPRET OR PREDICT WHY OR HOW THINGS HAPPENED OR WILL HAPPEN, WITH NO MEMORY AID.
USE AIDED		GIVEN CATEGORY CHARACTERISTICS AND GUIDELINES, CATEGORIZE OBJECTS, EVENTS, IDEAS, ACCORDING TO CHARACTERISTICS.	GIVEN STEPS OF THE PROCEDURE, APPLY THE PROCEDURE IN A SINGLE SITUATION, OR ON A SINGLE PIECE OF EQUIPMENT.	GIVEN THE FORMULA OR RULE STEPS, APPLY THE FORMULA OR RULE TO A VARIETY OF PROBLEMS OR SITUATIONS.	GIVEN A STATEMENT OF THE PRINCIPLE, INTERPRET OR PREDICT WHY OR HOW THINGS HAPPENED OR WILL HAPPEN.

STEP 4: Determine whether or not the OBJECTIVE is APPROPRIATE?

- 4a: Are the CONDITIONS appropriate for the work to be performed on the job or for later training?
- 4b: Are the STANDARDS appropriate for the work to be performed on the job or for later training?
- 4c: Is the TASK LEVEL of the ACTION appropriate for the work to be performed on the job or for later training?
- 4d: Is the CONTENT TYPE of the ACTION appropriate for the work to be performed on the job or for later training?
- 4e: If this objective is REMEMBER, is there a later USE objective?
- 4f: If this objective is USE-UNAIDED, is there a previous REMEMBER objective?
- 4g: If this objective is USE-AIDED, is the aid adequate, or are other objectives on the aid included?

Note, if the answer to 4d, 4e, or 4g is yes, and if the associated objective is to be taught in the present course, evaluate that objective next and keep the related objectives together throughout the IQI evaluation.

OBJECTIVE ADEQUACY PRACTICE

In this section, you will evaluate the sample objective for objective adequacy. For each objective, first determine whether or not it is correctly stated, then whether or not it is classifiable (you should refer to chapter 1), and finally whether or not it is appropriate. The examples are formatted as shown below. Some assumptions about conditions, standards, and appropriateness are indicated.

OBJECTIVE: _____

Correctly
Stated?

Conditions? _____

As mentioned in Volume II, many objectives contain "implicit" or implied conditions and standards. Unless otherwise stated in the objective, we will assume that the student is to perform under normal classroom conditions, is given paper and pencil, and is given appropriate instructions.

Standards? _____

Unless otherwise stated, we will assume that the student will write all responses, and that the responses must be "100% correct." Therefore, when an objective says "state" or "recall," we will assume this means "write from memory with 100% accuracy."

Action? _____

Classifiable? Task Level? _____

Content Type? _____

For these decisions, we will often refer to chapter 1.

Appropriate? Conditions? _____

Standards? _____

Action? _____

In these practice items, we have collapsed steps 4c (task level of action appropriate?) and 4d (content type of action appropriate?) into one step, "is the ACTION appropriate?"

Previous
Remember?

or

Later
Use-Unaided?

or

Aid
Adequate?

These objectives are taken "out of context." Therefore, some of the appropriateness decisions will be difficult to make. In general, we will assume that these objectives are from apprentice-level courses.

1. OBJECTIVE: The student will solve for total power in a DC parallel circuit.

Correctly Stated? Conditions? _____

Standards? _____

Action? _____

Classifiable? Task Level? _____

Content Type? _____

Appropriate? Conditions? _____

Standards? _____

Action? _____

Previous Remember? Later Use-Unaided? Aid Adequate? _____

REVISED
OBJECTIVE:

1. OBJECTIVE: The student will solve for total power in a DC parallel circuit.

Correctly
Stated?

Conditions? INCOMPLETE

Although the student is asked to solve for total power, there is no way to tell what circuit values he is given. The objective should specify what variables values will be given for, so that the correct power formula can be chosen.

Standards? INCOMPLETE

The implied standard is 100%, but a precision (e.g. two decimal places) should be specified.

Action? OK - ONE ACTION

Classifiable? Task Level? USE-UNAIDED

See Chapter 1.

Content Type? RULE

Appropriate? Conditions? ?

The revised conditions should be appropriate for the job.

Standards? SEE ABOVE

Action? OK

Previous Later Aid
Remember? Use-Unaided? Adequate? ?

There should be a previous objective requiring the student to recall the appropriate formulae, for solving for total power.

REVISED
OBJECTIVE:

The student will solve for total power in a given DC parallel circuit, given values for any two of the following: current, voltage or resistance. Answer will be accurate to two decimal places.

2. OBJECTIVE: The student will destroy classified material under routine conditions given the outline in OPNAVINST5510.1 and KAG-1.

Correctly
Stated?

Conditions? _____

Standards? _____

Action? _____

Classifiable? Task Level? _____

Content Type? _____

Appropriate? Conditions? _____

Standards? _____

Action? _____

Previous	Later	Aid	
Remember?	Use-Unaided?	Adequate?	_____

REVISED
OBJECTIVE:

2. OBJECTIVE: The student will destroy classified documents under routine conditions given the outline in OPNAVINST5510.1 and KAG-1.

Correctly
Stated?

Conditions? ?

This depends on whether "routine conditions" are defined in the OPNAV instruction.

Standards? ?

This depends on whether standards are specified in the references.

Action? OK - ONE ACTION

The action is "destroy."

Classifiable? Task Level? USE-AIDED

Content Type? PROCEDURE

See Chapter 1.

Appropriate? Conditions? ?

Will the student always have the aid available when he is destroying classified documents? Under routine conditions this seems plausible, would the same situation be true if it were an emergency?

Standards? ?

A reasonable time limit should be specified. The reference instructions may state time limits and other standards.

Action? OK

Previous Later

Remember? Use-Unaided?

Aid

Adequate?

 ?

The outline should be complete and the student should be able to follow the instructions easily to perform the task.

REVISED
OBJECTIVE:

Given the outline in OPNAVINST 5510.1 and KAG-1, the student will destroy classified documents under routine conditions in accordance with the time limits and standards established in the above documents.

3. OBJECTIVE: The student will describe the characteristics that are used in identifying circular, sector, conical & steady scans on an analysis scope & by listening to audio output.

Correctly
Stated?

Conditions? _____

Standards? _____

Action? _____

Classifiable? Task Level? _____

Content Type? _____

Appropriate? Conditions? _____

Standards? _____

Action? _____

Previous Later Aid
Remember? Use-Unaided? Adequate? _____

REVISED
OBJECTIVE:

3. OBJECTIVE: The student will describe the characteristics that are used in identifying circular, sector, conical & steady scans on an analysis scope & by listening to audio output.

Correctly
Stated?

Conditions? IMPLIED

Standards? INCOMPLETE

The implied standard is 100% which is OK. However, for standards to be complete, and for the objective to communicate clearly, the characteristics that the student must remember should be specified.

Action? OK - ONE ACTION

Classifiable? Task Level? REMEMBER

Content Type? CATEGORY

See discussion in Chapter 1.

Appropriate? Conditions? OK

Standards? ?

The standards specified above should be like those he will encounter on the job.

Action? OK

Previous Later Aid
Remember? Use-Unaided? Adequate? ?

There should be a later Use-unaided objective asking the student to classify radar signals according to types of scans.

REVISED
OBJECTIVE:

The student will describe the radar signal parameter measurement characteristics of SPS & PRF that are used in identifying circular, sector, conical & steady types of scans on an analysis scope & by listening to audio output.

4. OBJECTIVE: The student will recall the proper sequence of steps for testing a transistor using a multimeter.

Correctly
Stated?

Conditions? _____

Standards? _____

Action? _____

Classifiable? Task Level? _____

Content Type? _____

Appropriate? Conditions? _____

Standards? _____

Action? _____

Previous Later Aid
Remember? Use-Unaided? Adequate? _____

REVISED
OBJECTIVE:

4. OBJECTIVE: The student will recall the proper sequence of steps for testing a transistor using a multimeter.

Correctly
Stated?

Conditions? INCOMPLETE

The type of multimeter should be specified since each model has its unique way of being set up and connected for troubleshooting. Also the objective should specify that resistance is to be tested. When a multimeter is used to test transistors, you are concerned about measuring resistance only.

Standards? IMPLIED

Action? OK - ONE ACTION

Classifiable? Task Level? REMEMBER

Content Type? PROCEDURE

Appropriate? Conditions?

The conditions should be revised as specified. The job changes with each multimeter model.

Standards? OK

Action? OK

Previous Later Aid
Remember? Use-Unaided? Adequate? ?

There should be a later objective requiring the student to test a transistor resistance using the multimeter.

REVISED

OBJECTIVE:

The student will recall the sequence of steps for setting up and connecting a Simpson 260P multimeter to test a transistor's resistance.

5. OBJECTIVE: The student will state Ohm's Law.

Correctly
Stated?

Conditions?

Standards?

Action?

Classifiable? Task Level?

Content Type?

Appropriate? Conditions?

Standards?

Action?

Previous
Remember?

Later
Use-Unaided?

Aid
Adequate?

REVISED
OBJECTIVE:

5. OBJECTIVE: The student will state Ohm's Law.

Correctly
Stated?

Conditions?

IMPLIED

Standards?

IMPLIED

Action?

OK - ONE ACTION

Classifiable? Task Level?

REMEMBER

Content Type?

?

As discussed in Chapter 1, this could be either Rule or Principle. The objective must be rewritten to clarify whether a formula is to be remembered or an explanation of the relationships implied in Ohm's Law is to be remembered.

Appropriate?

Conditions?

OK

Standards?

OK

100% accuracy is appropriate.

Action?

OK

If the job or later training requires the student to use Ohm's Law un-aided, then recall is appropriate.

Previous
Remember?

Later
Use-Unaided?

Aid
Adequate?

?

There should be a later Use-unaided objective that requires the student to solve for current in a circuit.

REVISED
OBJECTIVE:

The student will state the Ohm's Law formula ($I = \frac{E}{R}$) for calculating total current in a circuit.

6. OBJECTIVE: The student will explain why no current is flowing in a simple series circuit given ohmmeter and voltmeter readings.

Correctly Stated? Conditions? _____

Standards? _____

Action? _____

Classifiable? Task Level? _____

Content Type? _____

Appropriate? Conditions? _____

Standards? _____

Action? _____

Previous Remember? Later Use-Unaided? Aid Adequate? _____

REVISED
OBJECTIVE:

6. OBJECTIVE: The student will explain why no current is flowing in a simple series circuit given ohmmeter and voltmeter readings.

Correctly
Stated?

Conditions? INCOMPLETE

The conditions must be more specific so you can duplicate the training situation by reading the objective. Are you training to recognize an open or short circuit in this case? Is a schematic given, or is an actual circuit given?

Standards? INCOMPLETE

What must the students' explanation contain in order to be scored correctly?

Action? OK - ONE ACTION

Classifiable? Task Level? USE-UNAIDED

Content Type? PRINCIPLE

See Chapter 1. The way the objective is written it is now clear the content type is principle.

Appropriate? Conditions? ?

With the objective revised to add more detail about the circuit, the conditions should be similar to actual problems in circuits. It is important that they are typical of what the student will see on the job.

Standards? ?

The standards should be specified as discussed above.

Action? YES

If we assume that students will learn troubleshooting skills, it would be appropriate for students to generate explanations of causes of circuit problems.

Previous Remember? Later Aid Use-Unaided? Adequate? ?

This objective is out of context. There should be a previous objective on recall of electronic theory about circuit behavior based on Ohm's Law.

REVISED

OBJECTIVE: Given ohmmeter & voltmeter readings indicating an open component, the student will explain, using his knowledge of electronic theory, why no current is flowing in a simple series circuit shown in a schematic. The answer will be in terms of

7. OBJECTIVE: Given the formula for capacitive reactance and the values of frequency & capacitance from a schematic, the student will calculate capacitive reactance.

Correctly
Stated?

Conditions? _____

Standards? _____

Action? _____

Classifiable? Task Level? _____

Content Type? _____

Appropriate? Conditions? _____

Standards? _____

Action? _____

Previous Later Aid
Remember? Use-Unaided? Adequate? _____

REVISED
OBJECTIVE:

7. OBJECTIVE: Given the formula for capacitive reactance and the values of frequency & capacitance from a schematic, the student will calculate capacitive reactance.

Correctly
Stated?

Conditions? INCOMPLETE

For clear communication, the conditions should include the actual formula for capacitive reactance. Also some indication of the range and precision of given values should be included.

Standards? INCOMPLETE

The answer should be given in ohms, and a precision should be specified.

Action? OK - ONE ACTION

Classifiable? Task Level? USE-AIDED

Content Type? RULE

See Chapter 1.

Appropriate? Conditions? ?

The appropriateness of giving the formula as an aid, instead of having the student remember, should be considered.

Standards? ?

See above.

Action? OK

Previous Later
Remember? Use-Unaided? Aid Adequate? ?

The symbols used in the formula should have been defined previously.

REVISED
OBJECTIVE: Given the formula for capacitive reactance, $X_C = \frac{1}{2\pi fC}$ and a schematic with typical values for frequency and capacitance, the student will correctly calculate capacitive reactance in ohms, accurate to two decimal places.

8. OBJECTIVE: The student will classify materials as being separable or not separable from lube oil by the Sharples oil purifier.

Correctly
Stated? Conditions? _____

Standards? _____

Action? _____

Classifiable? Task Level? _____

Content Type? _____

Appropriate? Conditions? _____

Standards? _____

Action? _____

Previous Later Aid
Remember? Use-Unaided? Adequate? _____

REVISED
OBJECTIVE:

8. OBJECTIVE: The student will classify materials as being separable or not separable from lube oil by the Sharples oil purifier.

Correctly Stated? Conditions? IMPLIED

Standards? IMPLIED

The implied standard is 100% accuracy.

Action? OK - ONE ACTION

Classifiable? Task Level? REMEMBER

Content Type? FACT

See Chapter 1.

Appropriate? Conditions? OK

Standards? OK

100% accuracy is appropriate.

Action? UNCLEAR

"Classify" is inappropriate in this case. It would be better to say "recall" which materials are separable ...

Previous Later Aid
Remember? Use-Unaided? Adequate? ?

This fact should later be used to support other Remember or Use objectives.

REVISED
OBJECTIVE: The student will recall the substances that can and cannot be successfully separated from lube oil by the Sharples oil purifier.

9. OBJECTIVE: The student will explain how hydraulic systems work.

Correctly
Stated? Conditions? _____

Standards? _____

Action? _____

Classifiable? Task Level? _____

Content Type? _____

Appropriate? Conditions? _____

Standards? _____

Action? _____

Previous Later Aid
Remember? Use-Unaided? Adequate? _____

REVISED
OBJECTIVE:

9. OBJECTIVE: The student will explain how hydraulic systems work.

Correctly
Stated?

Conditions?

IMPLIED

Standards?

INCOMPLETE

It is important that the standards in principle objectives be spelled out so both the instructor and student know what's expected. The objective must specify what the student's explanation should contain in order to be correct.

Action?

OK - ONE ACTION

Classifiable? Task Level?

?

See Chapter 1. The wording should be revised to make it clear what the student should do.

Content Type?

PRINCIPLE

Appropriate? Conditions?

YES

Standards?

?

The standards should be revised as described above.

Action?

?

*The revised action should be appropriate for the job.
Let's assume recall of the principle is required.*

Previous
Remember?

Later
Use-Unaided?

Aid

Adequate?

?

There should be a later objective requiring the student to use his knowledge of hydraulic systems in a new application.

REVISED
OBJECTIVE:

The student will recall how hydraulic systems work; the explanation should include the following points

10. OBJECTIVE: The student will sort pictures of clouds into stacks by type, given labeled illustrations of identified clouds.

Correctly Stated? Conditions? _____

Standards? _____

Action? _____

Classifiable? Task Level? _____

Content Type? _____

Appropriate? Conditions? _____

Standards? _____

Action? _____

Previous Later Aid
Remember? Use-Unaided? Adequate? _____

REVISED
OBJECTIVE:

10. OBJECTIVE: The student will sort pictures of clouds into stacks by type, given labeled illustrations of identified clouds.

Correctly
Stated?

Conditions? INCOMPLETE

There is an aid given to use as a "prototype" in matching new illustrations to the correct types. However, the exact types of clouds to be identified should be specified.

Standards? YES

The implied standard is "100%."

Action? OK - ONE ACTION

Classifiable? Task Level? USE-AIDED

Content Type? CATEGORY

The phrase "sort by type" is usually indicative of the Category content classifications.

Appropriate? Conditions? ?

Is the aid typical of what the student will have available on the job?

Standards? ?

The implied standard is "100%." Is this appropriate, or can some classification errors be tolerated?

Action? ?

A subject-matter expert should be consulted about the appropriateness of the aid. Is an aid available on the job, or must the task be performed unaided?

Previous Later Aid
Remember? Use-Unaided? Adequate? ?

If it is decided the aid is appropriate, then, is it adequate to stand alone? Is there additional training necessary before it can be used?

REVISED
OBJECTIVE:

The student will identify pictures of clouds as cumulus, stratus and cirrus, given a set of correctly identified picture examples of each type illustrating the critical characteristics of each.

11. OBJECTIVE: Given an oscilloscope, the student will calibrate the 10XMX -2817V test prod.

Correctly Stated? Conditions? _____

Standards? _____

Action? _____

Classifiable? Task Level? _____

Content Type? _____

Appropriate? Conditions? _____

Standards? _____

Action? _____

Previous Remember? Later Use-Unaided? Aid Adequate? _____

REVISED
OBJECTIVE:

11. OBJECTIVE: Given an oscilloscope, the student will calibrate the 10XMX -2817V test prod.

Correctly
Stated?

Conditions? SPECIFIED

The oscilloscope is a tool the student may use to help him accomplish the task. It is not an aid.

Standards? NO

Are there tolerances which the test prod calibration is required to meet? Is there a limit to how much time is allowed? These must be specified.

Action? OK - ONE ACTION

One verb: "calibrate"

Classifiable? Task Level? USE-UNAIDED

Content Type? PROCEDURE

Appropriate? Conditions? OK

Standards? ?

*The standards should be revised as suggested above.
The time limit should be appropriate for the job.*

Action? OK

Previous? Later? Aid?
Remember? Use-Unaided? Adequate? ?

There should be a previous objective requiring the student to remember the steps involved in calibrating a test prod.

REVISED
OBJECTIVE: Using an oscilloscope, the student will calibrate the 10XMX -2817V test prod to the required tolerances within ten minutes.

12. OBJECTIVE: Given an incoming signal the EW operator will identify the signal as being emitted from a particular type radar on a particular type platform.

Correctly Stated? Conditions? _____

Standards? _____

Action? _____

Classifiable? Task Level? _____

Content Type? _____

Appropriate? Conditions? _____

Standards? _____

Action? _____

Previous Remember? Later Use-Unaided? Aid Adequate? _____

REVISED
OBJECTIVE:

12. OBJECTIVE: Given an incoming signal the EW operator will identify the signal as being emitted from a particular type radar on a particular type platform.

Correctly
Stated?

Conditions? YES

This is like a simulation with an incoming signal.

Standards? ?

There should be a time limit set within which the radar and platform must be identified. Specific radars to be identified must be specified: search, fire control, airborne search, missile guidance; on specific platforms: surface ship, aircraft, submarine, land-based.

Action? OK- ONE ACTION

Classifiable? Task Level?

USE-UNAIDED

Content Type? CATEGORY

Appropriate? Conditions?

OK

The objective presumably represents what happens on the job.

Standards? ?

Check with an SME to find time limits appropriate for training EW operators in signal analysis. Also, add the specific described above.

Action? OK

Previous Later Aid
Remember? Use-Unaided? Adequate? ?

There should be a previous remember category objective where the student describes the characteristics specified above for each type of radar & platform.

REVISED

OBJECTIVE: Given an incoming signal, the EW operator will identify the signal as being emitted from a particular type radar on a particular type platform in X minutes. Types of radar to be identified on types of platforms: 60

13. OBJECTIVE: Given diagrams that represent how the basic steam cycle works, the student will analyze how the auxiliary condensate system operates.

Correctly
Stated?

Conditions? _____

Standards? _____

Action? _____

Classifiable? Task Level? _____

Content Type? _____

Appropriate? Conditions? _____

Standards? _____

Action? _____

Previous Later Aid
Remember? Use-Unaided? Adequate? _____

REVISED
OBJECTIVE:

13. OBJECTIVE: Given diagrams that represent how the basic steam cycle works, the student will analyze how the auxiliary condensate system operates.

Correctly
Stated?

Conditions?

SPECIFIED

A diagram is presented to the student as a memory aid.

Standards?

INCOMPLETE

The implied standard is "correctly" but a complete principle objective must include a more detailed description of the key points that need to be included in the explanation.

Action?

OK - ONE ACTION

Classifiable? Task Level?

USE-AIDED

See Chapter 1. The student must apply learned principles about the steam plant to new equipment so that if non-routine problems arise he can figure out what to do.

Content Type?

PRINCIPLE

Appropriate? Conditions?

?

What do the diagrams contain? If these already exist, they must be referenced. If not, they must be described.

Will the student be given diagrams only during apprentice-level training and test situations or will the diagrams actually be available near the equipment on the job?

Standards?

See Above

Action?

?

Does the student need to analyze how the auxiliary condensate system operates? Is the job performance bottom line to 1) operate it correctly? 2) maintain it or 3) predict answers to "what would happen if ..." questions? These questions must be answered to evaluate the adequacy of the objective as it reflects the job the student will be expected to do after training. Check with a subject-matter expert.

Previous Later

Remember? Use-Unaided?

Aid

Adequate?

?

Should other training be given before the aid can be meaningful? For instance, there may be objectives on the steam cycle that must be met before the diagrams can begin to act as a cue to "get at" the underlying principles involved.

REVISED
OBJECTIVE:

The standards should be revised as indicated above. Other revisions depend on a subject-matter expert's answer to the appropriateness questions.

Chapter 3

TEST CONSISTENCY AND TEST ADEQUACY

Introduction

At this point, the objectives for the instructional program have been checked for adequacy and revised if necessary. The next step is to check the test items, to make sure they are consistent with objectives, and are adequate.

In any instructional program, each test item should be tied or "referenced" to a specific objective. Since each objective is a statement of a "criterion" for student performance, tests for the objectives are called "criterion-referenced" tests.

A test item is "referenced" to an objective (criterion) when it is consistent with the objective. Consistency means that the conditions and standards in the objective must be maintained in the testing situation. Also, the task/content of the test item must match the task/content of the objective. Finally, the format of the test item must be appropriate for the task/content classification of the objective.

A test item can be consistent with an objective but still be a bad item. An adequate item is one which is clear, unambiguous, well-constructed, and free of "hints." Also, for an objective, there must be enough items to test the objective adequately, and the student must be given the opportunity on the test to make errors that are commonly made on the job.

On the following pages, the TEST CONSISTENCY and TEST ADEQUACY procedures from Volume IV are reproduced followed by practice items and feedback.



INSTRUCTIONAL
QUALITY
INVENTORY

TEST CONSISTENCY

CARD 2

- STEP 1: ENTER the COURSE TITLE and OBJECTIVE NUMBER at the top of the form.
- STEP 2: ENTER the TEST ITEM NUMBERS for the items associated with this objective on the form.
- STEP 3: DETERMINE whether or not the CONDITIONS in each item, or the CONDITIONS under which the items are administered, match the conditions in the objective.
- STEP 4: DETERMINE whether or not the STANDARDS in each item, or the STANDARDS for scoring each item, match the standards in the objective.
- STEP 5: DETERMINE whether or not the ACTIONS in each item match the action of the objective.
- STEP 5a: Determine the TASK LEVEL and CONTENT TYPE of each test item.
- STEP 5b: Determine whether these match the TASK LEVEL and CONTENT TYPE of the objective.
- STEP 6: DETERMINE whether or not each item is typical of the job to be performed after training, or is a necessary qualification for later training.
- STEP 7: DETERMINE whether or not the FORMAT of each item is APPROPRIATE for the TASK LEVEL and CONTENT TYPE. Use the table below:

TASK LEVEL	CONTENT TYPE				
	FACT	CATEGORY	PROCEDURE	RULE	PRINCIPLE
REMEMBER	for RECOGNITION: matching true-false multiple choice for RECALL: short answer fill-in listing	short answer fill-in listing	short answer fill-in listing	short answer fill-in listing	short answer fill-in listing
USE-UNAIDED		performance matching true-false multiple choice short answer fill-in	performance true-false multiple choice short answer fill-in	performance true-false multiple choice short answer fill-in	performance true-false multiple choice short answer fill-in
USE-AIDED		performance matching true-false multiple choice short answer fill-in	performance true-false multiple choice short answer fill-in	performance true-false multiple choice short answer fill-in	performance true-false multiple choice short answer fill-in



TEST ADEQUACY

CARD 3

- STEP 1: DETERMINE whether or not each item is CLEAR. Instructions for completing the item must specify what response the student is expected to make.
- STEP 2: DETERMINE whether or not each item is UNAMBIGUOUS. Each item must have one and only one correct response, and the item must be interpretable in only one way. That is, items must not be confusing.
- STEP 3: DETERMINE whether or not each item is WELL CONSTRUCTED. Different criteria apply to different item formats:
- TRUE-FALSE items: An item should include only one statement to be judged true or false. Negative statements should be avoided. Don't use words like "never," "always," etc. Item statements should be short.
- MULTIPLE CHOICE items: All alternatives should be plausible. Negatives in the item stem should be highlighted. Repetitive phrases should be placed in the stem, not in the alternatives. Alternatives like "all of the above," "A and B only," should be avoided.
- MATCHING items: Instructions should explain the contents of each column, and explain the basis for matching. Instructions should specify how many times each answer may be used. The choice column should include extra answers unless answers may be used more than once.
- FILL-IN items: The blank should be at or near the end of the sentence. One and only one phrase should correctly complete the item. Multiple blanks should be avoided. Blanks should require key words.
- SHORT ANSWER items: The required answer should be kept short. The directions to the student should specify how the item will be scored. The scoring key should identify allowable synonyms or alternatives.
- LISTING items: The directions should specify the number of things to be listed (if appropriate for the objective, and if the number of things is not a hint). The directions should specify whether or not order is important. If so, the scoring key should score sequence separately. The scoring key should identify allowable synonyms or alternatives, and should specify different weights if appropriate.
- PERFORMANCE items: The directions should clearly explain what the student is to do and how the item will be scored. The scoring key must specify all criteria the performance must meet, such as completeness, accuracy, quality, time limit, rate, etc. If steps in the performance are scored, a checklist should be provided.
- STEP 4: DETERMINE whether or not each item is FREE of HINTS. An item should not give away the answer to itself or to any other item on the test. The grammar of multiple-choice and fill-in items should not give hints to answers.
- STEP 5: DETERMINE whether or not the items allow for COMMON ERRORS to be made.
- STEP 6: For USE-level objectives, DETERMINE whether or not there are ENOUGH ITEMS to test the objective adequately, and to reflect the range of performance required on the job.

TEST CONSISTENCY & ADEQUACY PRACTICE

This section repeats the "revised objectives" from Chapter 2, and includes one test item for each. For the test items, first determine whether or not the item is consistent with its objective, and then whether or not it is adequate.

1. OBJECTIVE: The student will solve for total power in a given DC parallel circuit, given values for any two of the following: current, voltage or resistance. The answer will be accurate to two decimal places.

TEST ITEM: In the circuit below, the current and voltage are given. Calculate total power.

Consistent? Conditions Match? _____

Standards Match? _____

Actions Match? _____

Typical? _____

Format O.K.? _____

Adequate? Clear? _____

Unambiguous? _____

Well Constructed? _____

Free of Hints? _____

Common Errors? _____

Enough Items? _____

REVISED
TEST ITEM:

1. OBJECTIVE: The student will solve for total power in a given DC parallel circuit, given values for any two of the following: current, voltage or resistance. The answer will be accurate to two decimal places.

TEST ITEM: In the circuit below, the current and voltage are given. Calculate total power.

Consistent? Conditions Match? YES

Standards Match? YES

Actions Match? YES

Typical? ?

We will assume that the circuit and the values of current and voltage are typical of those found on the job.

Format O.K.? YES

Adequate? Clear? YES

Unambiguous? YES

Well Constructed? YES

Free of Hints? YES

Common Errors? ?

Check with a subject-matter expert to see if common errors were tested.

Enough Items? ?

Check with a subject-matter expert to determine how many items are required to test the objective adequately.

REVISED
TEST ITEM: OK

2. OBJECTIVE: Given the outline in OPNAVINST 5510.1 and KAG-1, the student will destroy classified documents under routine conditions in accordance with the time limits and standards established in the OPNAVINST 5510.1.
- TEST ITEM: Using your copies of OPNAVINST 5510.1 and KAG-1, destroy your classified documents under routine conditions.

Consistent? Conditions Match? _____

Standards Match? _____

Actions Match? _____

Typical? _____

Format O.K.? _____

Adequate? Clear? _____

Unambiguous? _____

Well Constructed? _____

Free of Hints? _____

Common Errors? _____

Enough Items? _____

REVISED
TEST ITEM:

2. OBJECTIVE: Given the outline in OPNAVIST 5510.1 and KAG-1, the student will destroy classified documents under routine conditions in accordance with the time limits and standards established in the OPNAVINST 5510.1.

TEST ITEM: Using your copies of OPNAVINST 5510.1 and KAG-1, destroy your classified documents under routine conditions.

Consistent? Conditions Match? YES

Standards Match? ?

Time limits and quality standards must be met - the test item should mention these.

Actions Match? YES

Both are use-aided procedures.

Typical? YES

It is obvious that outdated classified documents must be destroyed.

Format O.K.? YES

The student is actually asked to perform the task of destroying classified documents.

Adequate? Clear? YES

Unambiguous? ?

It should be clear which classified documents are to be destroyed.

Well Constructed? ?

The scoring key must specify all criteria the performance must meet. If steps are scored, a checklist should be provided. Check with a subject-matter expert.

Free of Hints? YES

Common Errors? ?

If classified documents that are to be retained are included along with those to be destroyed, the student must discriminate the outdated documents that are required to be destroyed.

Enough Items? ?

Check with a subject-matter expert for an estimate of whether there are enough items for simulating a job situation.

REVISED

TEST ITEM: Here is a set of classified documents. Use your copies of OPNAVINST 5510.1 and KAG-1 to guide you in completely destroying the outdated documents under routine conditions within the stated time limit.

The student will describe the radar signal parameter measurement characteristics of SPS & PRF that are used in identifying circular sector, conical & steady types of scans on an analysis scope and by listening to audio output.

3.OBJECTIVE: TEST ITEM: Using your scope and audio output, identify the following signals according to circular, sector, conical, or steady types of scans.

Consistent? Conditions Match? _____

Standards Match? _____

Actions Match? _____

Typical? _____

Format O.K.? _____

Adequate? Clear? _____

Unambiguous? _____

Well Constructed? _____

Free of Hints? _____

Common Errors? _____

Enough Items? _____

REVISED
TEST ITEM:

3. OBJECTIVE: The student will describe the radar signal parameter measurement characteristics of SPS & PPF that are used in identifying circular sector, conical & steady types of scans on an analysis scope & by listening to audio output.

TEST ITEM: Using your scope and audio output, identify the following signals according to circular, sector, conical, or steady types of scans.

Consistent? Conditions Match? NO

The objective calls for a paper & pencil answer. However, the student is actually given a radar signal and equipment in the test item.

Standards Match? YES

Actions Match? NO

The task/content level of the objective is Remember Category while the test item is Use-unaided Category.

Typical? YES

For later signal analysis the student will have to identify types of scans.

Format O.K.? NO

Format should be fill-in, since the objective requires the student to "describe."

Adequate? Clear? Not applicable

Unambiguous? _____

If the item is not consistent, it must be rewritten before adequacy can be determined.

Well Constructed? _____

Free of Hints? _____

Common Errors? _____

Enough Items? _____

REVISED TEST ITEM: Describe the radar signal parameter measurement characteristics of each type of scan: circular, sector, conical & steady. For credit, all characteristics must be described.

4. OBJECTIVE: The student will recall the sequence of steps for setting up and connecting a Simpson 260P multimeter to test a transistor's resistance.

TEST ITEM: List the sequence of steps for setting up & connecting a Simpson 260P multimeter to test the resistance of a transistor.

Consistent? Conditions Match? _____

Standards Match? _____

Actions Match? _____

Typical? _____

Format O.K.? _____

Adequate? Clear? _____

Unambiguous? _____

Well Constructed? _____

Free of Hints? _____

Common Errors? _____

Enough Items? _____

REVISED
TEST ITEM:

4. OBJECTIVE: The student will recall the sequence of steps for setting up & connecting a Simpson 260P multimeter to test a transistor's resistance.

TEST ITEM: List the sequence of steps for setting up & connecting a Simpson 260P multimeter to test the resistance of a transistor.

Consistent? Conditions Match? Yes

Standards Match? Yes

Actions Match? Yes

Typical? Yes

Format O.K.? Yes

Adequate? Clear? Yes

Unambiguous? Yes

Well Constructed? ?

The scoring key should score sequence separately since this is part of the objective standards.

Free of Hints? Yes

Common Errors? Yes

Enough Items? Not applicable

REVISED
TEST ITEM:

OK

5. OBJECTIVE: The student will state the Ohm's Law formula ($I = \frac{E}{R}$) for calculating for total current in a circuit.

TEST ITEM: Choose the correct Ohm's Law formula.

a. $X_L = 2\pi fL$

c. $I = \frac{E}{R}$

b. $R = IE$

d. None of the above.

Consistent?

Conditions Match? _____

Standards Match? _____

Actions Match? _____

Typical? _____

Format O.K.? _____

Adequate?

Clear? _____

Unambiguous? _____

Well Constructed? _____

Free of Hints? _____

Common Errors? _____

Enough Items? _____

REVISED
TEST ITEM:

5. OBJECTIVE: The student will state the Ohm's Law formula ($I = \frac{E}{R}$) for calculating total current in a circuit.

TEST ITEM: Choose the correct Ohm's Law formula.

a. $X_L = 2\pi fL$

c. $I = \frac{E}{R}$

b. $R = IE$

d. None of the above.

Consistent? Conditions Match? NO

The objective asks the student to state the formula - he is given no help. The test item gives the student several rules; one of which is right.

Standards Match? YES

Actions Match? NO

The task/content classification is Remember Rule but the actions do not match. The objective asks the student to "state" while the action for the test item is "choose."

Typical? NO

The reason the objective requires recall is because the job does. On the job, the student will probably never have to pick one from a list. He must remember it without prompts.

Format O.K.? NO

Multiple choice formats are never appropriate for Remember Rule. They make both the action and conditions inconsistent.

Adequate? Clear? Not applicable.

Unambiguous? _____

Well Constructed? _____

Free of Hints? _____

Common Errors? _____

Enough Items? _____

The item is also not well constructed because multiple choice items should not include alternatives like "none of the above."

REVISED TEST ITEM: State the formula for Ohm's Law used in calculating total current in a circuit.

6. OBJECTIVE:

Given ohmmeter & voltmeter readings indicating an open component, the student will explain, using his knowledge of electronic theory, why no current is flowing, in a simple series circuit shown in a schematic. The answer will be in terms of Ohm's Law and an open component reading infinite resistance or full source voltage.

TEST ITEM: Here are ohmmeter & voltmeter readings for the simple series circuit shown. Troubleshoot the circuit to explain why no current is flowing.

Consistent? Conditions Match? _____

Standards Match? _____

Actions Match? _____

Typical? _____

Format O.K.? _____

Adequate? Clear? _____

Unambiguous? _____

Well Constructed? _____

Free of Hints? _____

Common Errors? _____

Enough Items? _____

REVISED
TEST ITEM:

Given ohmmeter & voltmeter readings indicating an open component, the student will explain, using his knowledge of electronic theory, why no current is flowing in a simple series circuit shown in the schematic. The answer will be in terms of Ohm's Law and an open component reading infinite resistance or full source voltage.

6. OBJECTIVE:

TEST ITEM:

Here are ohmmeter & voltmeter readings for the simple series circuit shown. Explain why no current is flowing.

Consistent? Conditions Match? YES

Standards Match? ?

The scoring standards should be spelled out for the student.

Actions Match? YES

Typical? YES

Format O.K.? YES

Adequate? Clear? YES

Unambiguous? YES

Well Constructed? ?

The directions to the student should specify how the item will be scored and what the student must include in his response.

Free of Hints? ?

When the student is told what to include in his response for full credit, the instructor must be careful not to give away the answers to the question.

Common Errors? ?

Enough Items? ?

A subject-matter expert can suggest when this topic has been adequately tested.

REVISED
TEST ITEM: *add "in the explanation your answer should include"*

Given the formula for capacitive reactance, $X_c = \frac{1}{2\pi fC}$

7. OBJECTIVE: and a schematic with typical values for frequency & capacitance, the student will correctly calculate capacitive reactance in ohms, accurate to two decimal places.

TEST ITEM: Solve for capacitive reactance in ohms given the formula $X_c = \frac{1}{2\pi fC}$ and the values for frequency & capacitance shown in the circuit below. Your answer should be accurate to two decimal places.

Consistent? Conditions Match? _____

Standards Match? _____

Actions Match? _____

Typical? _____

Format O.K.? _____

Adequate? Clear? _____

Unambiguous? _____

Well Constructed? _____

Free of Hints? _____

Common Errors? _____

Enough Items? _____

REVISED
TEST ITEM:

Given the formula for capacitive reactance, $X_c = \frac{1}{2\pi fC}$ and a schematic with typical values for frequency & capacitance, the student will correctly calculate capacitive reactance in ohms, accurate to two decimal places.

7. OBJECTIVE:

TEST ITEM: Solve for capacitive reactance in ohms given the formula $X_c = \frac{1}{2\pi fC}$ and the values for frequency & capacitance shown in the circuit below. Your answer should be accurate to two decimal places.

Consistent? Conditions Match? YES

Both test item & objective require the student to read the schematic of a circuit to find the values.

Standards Match? YES

Actions Match? YES

Typical? ?

We will assume the values are typical of the job.

Format O.K.? YES

Adequate? Clear? YES

Unambiguous? YES

Well Constructed? YES
Directions to the student should indicate if partial credit will be given in scoring.

Free of Hints? YES

Common Errors? ?

Enough Items? ?
Check with a subject-matter expert to see that common errors have been tested and there are enough items to adequately test the ability to solve the rule correctly.

REVISED
TEST ITEM: Ck

8. OBJECTIVE: The student will recall the substances that can and cannot be successfully separated from lube oil by the Sharples oil purifier.

TEST ITEM: Recall what will happen to lube oil if insoluble substances have not been separated from it.

- a. c.
- b. d. a and b only

Consistent? Conditions Match? _____

Standards Match? _____

Actions Match? _____

Typical? _____

Format O.K.? _____

Adequate? Clear? _____

Unambiguous? _____

Well Constructed? _____

Free of Hints? _____

Common Errors? _____

Enough Items? _____

REVISED
TEST ITEM:

8. OBJECTIVE: The student will recall the substances that can and cannot be successfully separated from lube oil by the Sharples oil purifier.

TEST ITEM: Recall what will happen to lube oil if insoluble substances have not been separated from it.

- a. c.
b. d. a and b only

Consistent? Conditions Match? NO

In the objective the student is asked only which substances can & cannot be separated from lube oil. In the test item he is given several explanations, one of which he recognizes as correct.

Standards Match? YES

The implied standard in both the objective and test item is 100% accuracy.

Actions Match? NO

The task/content of the objective is remember fact while the test item is remember principle.

Typical? YES

The student will have to know how lube oil reacts when contaminated by insolubles because he must maintain gear that depends on lube oil to run properly. He must recognize the consequences of contaminated lube oil.

Format O.K.? NO

A multiple-choice item is not appropriate for any remember level objective except for recognition of a fact.

Adequate?	Clear?	<u>Not applicable.</u>	However, the item is not adequate either.
	Unambiguous?	_____	Alternatives like "a and b only" should not be used in the multiple-choice format.
	Well Constructed?	_____	The item is not well-constructed.
	Free of Hints?	_____	
	Common Errors?	_____	
	Enough Items?	_____	

REVISED TEST ITEM: List the substances that can be separated from lube oil by the Sharples oil purifier and those that cannot.

9. OBJECTIVE: The student will recall how hydraulic systems work.
The explanation should include the following points ...

TEST ITEM: In the space below, explain how hydraulic systems work.
For full credit include the following points

Consistent? Conditions Match? _____

Standards Match? _____

Actions Match? _____

Typical? _____

Format O.K.? _____

Adequate? Clear? _____

Unambiguous? _____

Well Constructed? _____

Free of Hints? _____

Common Errors? _____

Enough Items? _____

REVISED
TEST ITEM:

9. OBJECTIVE: The student will recall how hydraulic systems work.
The explanation should include the following points ...

TEST ITEM: In the space below, explain how hydraulic systems work.
For full credit include the following points

Consistent? Conditions Match? IMPLIED

Standards Match? YES

Actions Match? YES

*In both cases the student is asked to remember principles be
learned earlier.*

Typical? ?

*On the job will the knowledge of the principles of hydraulic systems
enable the student to do a better job?*

Format O.K.? YES

Adequate? Clear? YES

Unambiguous? YES

Well Constructed? YES

*The student is told exactly what he must do to answer the question,
and how he will be scored.*

Free of Hints? ?

*Do the instructions give away the answer when the student is told
what to include in his answer?*

Common Errors? ?

Enough Items? NOT APPLICABLE

REVISED
TEST ITEM: OK

10. OBJECTIVE: The student will identify pictures of clouds as cumulus, stratus, and cirrus given a set of correctly identified picture examples of each type illustrating the critical characteristics of each.

TEST ITEM: Here are pictures of clouds identified as cumulus, cirrus and stratus. Which of the examples pictured below are cumulus clouds?

Consistent? Conditions Match? _____

Standards Match? _____

Actions Match? _____

Typical? _____

Format O.K.? _____

Adequate? Clear? _____

Unambiguous? _____

Well Constructed? _____

Free of Hints? _____

Common Errors? _____

Enough Items? _____

REVISED
TEST ITEM:

The student will identify pictures of clouds as cumulus, stratus, and cirrus given a set of correctly identified picture examples of each type illustrating the critical characteristics of each.

10. OBJECTIVE:

TEST ITEM: Here are pictures of clouds identified as cumulus, cirrus and stratus. Which of the examples pictured below are cumulus clouds?

Consistent? Conditions Match? NO

The student is asked to identify only the cumulus clouds. The objective also requires him to recognize cirrus and stratus clouds. The conditions are not all present in this item.

Standards Match? YES

Actions Match? YES

Both the objective and test item require the student to sort new pictures of clouds into certain categories, given an aid.

Typical? ?

Will the student be asked to identify clouds and recognize various types later? Check with your subject-matter expert! Future weather predictions may depend on it!

Format O.K.? YES

Adequate? Clear? NOT APPLICABLE

Unambiguous?

Well Constructed?

Free of Hints?

Common Errors?

Enough Items?

REVISED TEST ITEM: Using the identified pictures of cumulus, cirrus and stratus clouds given, sort the unidentified pictures of clouds into stacks by type.

11. OBJECTIVE: Using an oscilloscope, the student will calibrate the 10XX
-2817V test prod to the required tolerances within ten
minutes.

TEST ITEM: List the steps for calibrating an 10XX-2817V test prod
including the required tolerances.

Consistent? Conditions Match? _____

Standards Match? _____

Actions Match? _____

Typical? _____

Format O.K.? _____

Adequate? Clear? _____

Unambiguous? _____

Well Constructed? _____

Free of Hints? _____

Common Errors? _____

Enough Items? _____

REVISED
TEST ITEM:

Using an oscilloscope, the student will calibrate the 10XMX
11.OBJECTIVE: -2817V test prod to the required tolerances within ten minutes.

TEST ITEM: List the steps for calibrating an 10XMX -2817V test prod
including the required tolerances.

Consistent? Conditions Match? NO

*The objective gives the student an oscilloscope to use. The test
item requires a paper & pencil answer.*

Standards Match? NO

*The objective requires the student to actually calibrate the test
prod. Additionally he must complete the task in ten minutes.*

Actions Match? NO

*The conditions & action in the objective are different from those in
the test item. The objective is a use-unaided procedure, while the
test item is a remember procedure.*

Typical? YES

*The job requires that the student know the test prod's required
tolerances and the steps to calibrate it.*

Format O.K.? NO

The objective requires a performance test.

Adequate? Clear? NOT APPLICABLE

Unambiguous? _____

Well Constructed? _____

Free of Hints? _____

Common Errors? _____

Enough Items? _____

REVISED Within tolerances, calibrate the 10XMX -2817V test prod
TEST ITEM: using an oscilloscope. For full credit you must complete
this in ten minutes. You will receive partial credit if
you take longer.

12. OBJECTIVE: Given an incoming signal, the EW operator will identify the signal as being emitted from a particular type radar (search, fire control, airborne search, missile guidance) on a platform (surface ship, aircraft, submarine, land-based) in X minutes.

TEST ITEM: Given a series of incoming signals, identify each as being emitted from a particular radar on a particular platform in X minutes.

Consistent? Conditions Match? _____

Standards Match? _____

Actions Match? _____

Typical? _____

Format O.K.? _____

Adequate? Clear? _____

Unambiguous? _____

Well Constructed? _____

Free of Hints? _____

Common Errors? _____

Enough Items? _____

REVISED
TEST ITEM:

12. OBJECTIVE: Given an incoming signal, the EW operator will identify the signal as being emitted from a particular type radar (search, fire control, airborne search, missile guidance) on a platform (surface ship, aircraft, submarine, land-based) in X minutes.

TEST ITEM: Given a series of incoming signals, identify each as being emitted from a particular radar on a particular platform in X minutes.

Consistent? Conditions Match? YES

Standards Match? YES

Actions Match? YES

In both instances the student must recognize the radar & platform the signal is associated with.

Typical? YES

EW operators analyze incoming signals.

Format O.K.? YES

Adequate? Clear? YES

Unambiguous? YES

Well Constructed? ?

The scoring key should specify accuracy requirements for partial credit in addition to the time limit.

Free of Hints? YES

Common Errors? ?

Signals should be presented that are often confusing to new students so they can learn to discriminate the correct identification.

Enough Items? ?

There should be enough items to test each radar on a platform until you are confident the student recognizes each correctly.

REVISED
TEST ITEM: OK

13. OBJECTIVE: Given diagrams that represent how the basic steam cycle works, the student will analyze how the auxiliary condensate system operates. The analysis should include the following points

TEST ITEM: Here are diagrams representing the last two phases of the basic steam cycle. Using these as memory aids for the principles illustrated by them, analyze how the phases apply in the correct operation of the auxiliary condensate system.

Consistent? Conditions Match? _____

Standards Match? _____

Actions Match? _____

Typical? _____

Format O.K.? _____

Adequate? Clear? _____

Unambiguous? _____

Well Constructed? _____

Free of Hints? _____

Common Errors? _____

Enough Items? _____

REVISED
TEST ITEM:

- Given diagrams that represent how the basic steam cycle works, the student will analyze how the auxiliary condensate system operates. The analysis should include the following points
13. OBJECTIVE:

TEST ITEM: Here are diagrams representing the last two phases of the basic steam cycle. Using these as memory aids for the principles illustrated by them, analyze how the phases apply in the correct operation of the auxiliary condensate system.

Consistent? Conditions Match? NO

The objective states that diagrams are given for the entire steam cycle. The test item specifies only the diagram in the last two phases are given.

Standards Match? ?

The scoring standards should be given to the students and include the key points given in the objective.

Actions Match? YES

Typical? YES

Format O.K.? YES

Adequate? Clear? YES

Unambiguous? ?

Well Constructed? ?

As stated in Vol. II, the scoring standards for principle objectives should be as objective as possible for evaluating the student's responses.

*Free of Hints?
If more detailed instructions are given about the answer there is the problem of too many hints.*

Common Errors? ?

Enough Items? ?

REVISED TEST ITEM: Here are diagrams representing the phases of the basic steam cycle. Using these as memory aids for the principles illustrated by them, analyze how the phases apply in the correct operation of the auxiliary condensate system.

For full credit your analysis should include the following points

Chapter 4

PRESENTATION CONSISTENCY

Introduction

At this point, the objectives and test items for the instructional program are consistent with each other, and are adequate. The next step is to make sure that the instructional presentation is consistent with the objectives and test items.

The term "instructional presentation" covers all the ways instruction can be presented. This includes printed self-study materials, lectures, computer-assisted instruction, films or videotapes, tape-slide presentations, audio tape, videodisc, one-on-one tutorials, and any combination of these.

For a presentation to be consistent with an objective/test item, it must teach to the task level and content type of the objective/test item. This means that the presentation must contain certain components, depending on the task/content level. There are four main presentation components:

<u>Statement</u>	The student is given a statement of a fact, a category definition, the steps of a procedure or rule, or a statement of a principle.
<u>Example</u>	The student is told or shown how a statement of a category, procedure, rule, or principle applies in a specific case.
<u>Practice Remembering</u>	The student is asked to supply part or all of a fact statement, category definition, the steps of a procedure or rule, or a statement of a principle. The student is also given <u>feedback</u> about the correctness of his answer.
<u>Practice Using</u>	The student is asked to use a category definition, procedure, rule, or principle on a specific case to which it applies, and is given <u>feedback</u> about the quality of his performance.

Different combinations of these components are required, depending on the task level of the objective.

A component is counted as present in the instruction only if it is complete. This depends on the content type of the objective, and simply means that everything that needs to be included is included.

On the following page, the PRESENTATION CONSISTENCY procedure from Volume IV is reproduced followed by three instructional presentations you will evaluate using the procedure. Feedback for the presentations follows. Additional explanation is given in Volume II.

PRESENTATION CONSISTENCY



INSTRUCTIONAL
QUALITY
INVENTORY

CARD 4

- STEP 1: ENTER the COURSE TITLE and OBJECTIVE NUMBER at the top of the form.
- STEP 2: LOCATE the section of the presentation related to this objective.
- STEP 3: DETERMINE if the required PRESENTATION COMPONENTS are present for the task level of the objective. (Use the table below).

TASK LEVEL	REQUIRED PRESENTATION COMPONENTS			
	STATEMENT	PRACTICE REMEMBERING	EXAMPLES	PRACTICE USING
REMEMBER	<i>required</i>	<i>required</i>	<i>not required</i>	<i>not required</i>
USE-UNAIDED	<i>required unless the associated REMEMBER objective was taught recently.</i>		<i>required</i>	<i>required</i>
USE-AIDED	<i>the aid replaces statement</i>	<i>not required</i>	<i>required with aid</i>	<i>required with aid</i>

- STEP 4: DETERMINE whether or not each required PRESENTATION COMPONENT is COMPLETE for the content type of the objective (Use the table below). Examples and practice items must also match the task level of the objective.

PRESENTATION COMPONENT

CONTENT TYPE OF THE OBJECTIVE

	FACT	CATEGORY	PROCEDURE	RULE	PRINCIPLE
STATEMENT	complete fact presented	all critical characteristics and their combination are given	all steps are given in the correct order	all steps and branching decisions are given in the correct order	all causes, effects, and relationships are given
PRACTICE REMEMBERING	recall or recognition required	recall of category definition required	recall of all steps in correct order required	recall of all steps and branch decisions in correct order required	recall of all causes, effects, relationships required
For all content types: Practice Remembering items must be the same as the test item. They must be the same format as the test item. All practice items must include feedback.					
EXAMPLES	<i>not applicable</i>	examples show all critical characteristics required for classification, non-examples show absence of critical characteristics	application of the procedure must be shown and steps must be shown in the correct order	application of each step or branching decision must be shown in the correct order	interpretation or prediction based on causes, effects, and relationships must be shown
PRACTICE USING	<i>not applicable</i>	classification of both examples and non-examples is required	all steps must be performed in the correct order	all steps and branching decisions must be performed in the correct order	explanation or prediction based on the principle is required

For all content types: Practice Using items must reflect what is to be done on the job or in later training. The task/content level, conditions, and standards must match the test item and objective. The practice item format must be the same as the test item format. All practice items must include feedback.

For CATEGORIES, RULES, PRINCIPLES:

Some practice items should be different than either the test items or the examples. (Common error items might be the same.)

PRESENTATION CONSISTENCY PRACTICE

This section presents three examples of instructional presentations for you to evaluate. Write your comments in the margins. The first page of each example gives the objective and test item, and the analysis procedure for consistency as described on the previous page. At the end feedback about consistency is given *in italics* in the margins.

In the next chapter, the same examples are repeated and you will check them for adequacy. Then, revised versions of the example, which are consistent and adequate, are given.

Example 1.

OBJECTIVE: "Given a knife, a match, a shoe string and a scarf the student will demonstrate first aid for a snakebite when the victim develops severe symptoms.

TEST ITEM: Here is a knife, a match, a shoe string and a scarf. Apply first aid to the snakebite victim who has severe symptoms. Your instructor will watch and evaluate your performance. Simulate the cuts with a pen.

TASK/CONTENT

CLASSIFICATION: Use-unaided procedure

Since this objective is use-unaided, we have included a previous Remember objective as required in Step 4f of the Objective Adequacy procedure.

Previous Remember

Objective: The student will write from memory the steps of the procedure for first aid to snakebite victims with severe reaction.

Test Item: List the steps of the procedure applying first aid to a snakebite victim with severe symptoms.

Required
Presentation
Components:

You fill this in.

Completeness
Requirements:

You fill this in.

Example 1. Feedback

OBJECTIVE: "Given a knife, a match, a shoe string and a scarf the student will demonstrate first aid for a snakebite when the victim develops severe symptoms.

TEST ITEM: Here is a knife, a match, a shoe string and a scarf. Apply first aid to the snakebite victim who has severe symptoms. Your instructor will watch and evaluate your performance. Simulate the cuts with a pen.

TASK/CONTENT

CLASSIFICATION: Use-unaided procedure

Since this objective is use-unaided, we have included a previous Remember objective as required in Step 4f of the Objective Adequacy procedure.

Previous Remember

Objective: The student will write from memory the steps of the procedure for first aid to snakebite victims with severe reaction.

Test Item: List the steps of the procedure applying first aid to a snakebite victim with severe symptoms.

Required

Presentation

Components:

Statement of the steps for first aid to the snakebite victim.

Practice Remembering the steps of procedure.

Example showing the procedure being used.

Practice Using the first aid procedure. The student practices applying first aid.

Completeness

Requirements:

Statement: All steps must be given in the correct order.

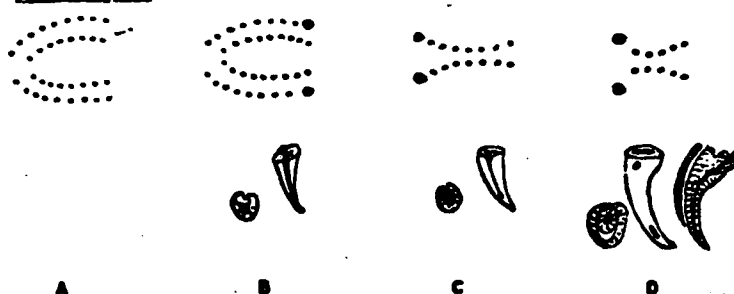
Practice Remembering: This must be like the test item for the Remember objective. Feedback must be given.

Examples: Each step of the procedure should be illustrated or demonstrated.

Practice Using: The student should practice first aid treatment on a "victim" simulating the incision step. For safety reasons, the instructor should supervise and must give feedback.

Do not consider this complete training for snakebite. The symptoms of snakebite fall into three categories with the severity of the symptoms determining the treatment. Here we deal only with the procedure for first aid of a severe reaction. There must be another objective for training the student to Remember the characteristics of different degrees of severity of snakebite symptoms and then a Use objective where he identifies the severity of the symptoms.

Instruction

Snakebite:

Identification of Snakes by Bite Impressions. A, nonpoisonous, no fangs, family Colubridae subfamily Colubrinae (U.S. garter snake, European ringed snake, black snake); B, poisonous, posterior fangs, fangs not hollow but grooved slightly, family Colubridae subfamily Boiginae (boomslang of Africa); C, poisonous, anterior fangs, fangs relatively short, deeply grooved, family Elapidae (mamba, mamba, water cobra, cobra, and coral snakes) and family Hydrophidae (sea snakes); D, poisonous, anterior fangs markedly separated from teeth, fangs long, relatively large, and completely hollow, family Viperidae (horned, sand, and tree vipers; puff adder), family Crotalidae (rattlesnakes, copperheads, water moccasins, fer-de-lance).

Figure 5-2.—Identification of snakes by bite impressions.

Treatment.—The first advice to give the snakebite victim is that he lie down and keep calm. Remind him that of those bitten, few die or are even disabled, if certain principals are followed. Since the identity of the snake is important in the selection of the antivenom, kill the snake (a sharp blow on the head is the best method) and, with a stick, examine the mouth for fangs. Fix the color and color pattern in mind and note the general appearance of the snake. (Unfortunately, most snakebites occur between twilight and daybreak when snakes are most active and identification most difficult. Identification in these situations can only be made by analyzing the symptoms.)

The following rules of first aid should be observed:

1. Immediately put the victim at rest and immobilize the affected part below the level of the heart. Keep him dry, warm, and quiet. Transportation should be by litter when possible.

2. When the bite is on the arm or leg, place a tourniquet 2 to 4 inches closer to the heart than the site of the bite. The tourniquet should be tight enough to stop the flow of blood in the veins but not in arteries. **EXCEPTION:** If the bite occurs in Africa, India, Burma, Thailand, or Australia where venoms that affect the nervous system are to be expected, or if the snake is positively identified as one possessing this type of venom, the tourniquet should be tight enough to restrict arterial flow and should be placed on the upper arm or upper leg where single bones make restriction possible. The tourniquet should be released for 30 seconds every 20 minutes to allow fresh blood to enter the extremity.

3. If more than 1 hour is going to elapse before antivenom can be injected, TRAINED RESCUERS may employ incision and suction. With a sharp, sterile instrument (sterilized with a match if no other means is available) make two cuts, each not more than 1/2 inch long and 1/4 inch deep. The cuts should be made over the fang marks, lengthwise along the arm or leg. The incision must not injure tendons, muscles, blood vessels, or nerves. Suction may be performed by suction cup, if available, or by mouth and continued for at least 30 minutes. The sooner suction is started the better. If as much as an hour has passed since the bite was inflicted, incision and suction should not be used.

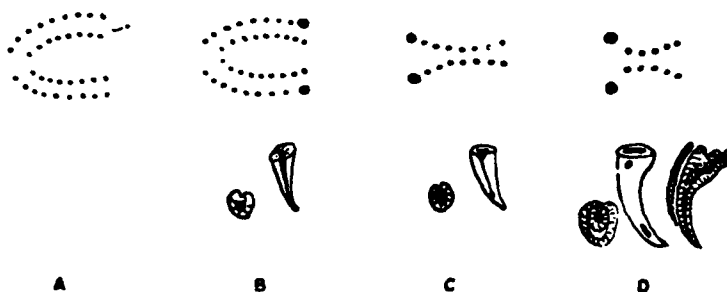
4. Antivenom should be given as soon as possible. This is best done by a physician because of difficulties that may arise from reactions to the serum. It should be administered as first aid only if medical assistance is not or will not be available and it is necessary to save the life of the victim.

5. Treat the victim for shock. Keep him lying down, make him as comfortable as possible, and keep him quiet. It may be necessary to give artificial respiration and cardiac massage. There are a number of cases on record where men have been kept alive as long as 2 hours after they became unconscious and have been saved by delayed injection of antivenom.

WHAT NOT TO DO: Morphine should not be given for pain when the venom is the type that affects the nervous system. Alcohol is forbidden—it speeds circulation. Ice packs and ice water should not be used—they have no proven value and may do considerable damage.

Instruction

Snakebite:



Identification of Snakes by Bite Impressions. A, nonpoisonous, no fangs, family Colubridae subfamily Colubrinae (U.S. garter snake, European ringed snake, black snake); B, poisonous, posterior fangs, fangs not hollow but grooved slightly, family Colubridae subfamily Boiginae (boomslang of Africa); C, poisonous, anterior fangs, fangs relatively short, deeply grooved, family Elapidae (kraits, mambas, water cobras, cobras, and coral snakes) and family Hydrophidae (sea snakes); D, poisonous, anterior fangs markedly separated from teeth, fangs long, relatively large, and completely hollow, family Viperidae (horned, sand, and tree vipers, puff adder), family Crotalidae (rattlesnakes, copperheads, water moccasins, fer-de-lance).

Figure 5-2.—Identification of snakes by bite impressions.

Treatment.—The first advice to give the snakebite victim is that he lie down and keep calm. Remind him that of those bitten, few die or are even disabled, if certain principals are followed. Since the identity of the snake is important in the selection of the antivenom, kill the snake (a sharp blow on the head is the best method) and, with a stick, examine the mouth for fangs. Fix the color and color pattern in mind and note the general appearance of the snake. (Unfortunately, most snakebites occur between twilight and daybreak when snakes are most active and identification most difficult. Identification in these situations can only be made by analyzing the symptoms.)

The following rules of first aid should be observed:

1. Immediately put the victim at rest and immobilize the affected part below the level of the heart. Keep him dry, warm, and quiet. Transportation should be by litter when possible.

2. When the bite is on the arm or leg, place a tourniquet 2 to 4 inches closer to the heart than the site of the bite. The tourniquet should be tight enough to stop the flow of blood in the veins but not in arteries. **EXCEPTION:** If the bite occurs in Africa, India, Burma, Thailand, or Australia where venoms that affect the nervous system are to be expected, or if the snake is positively identified as one possessing this type of venom, the tourniquet should be tight enough to restrict arterial flow and should be placed on the upper arm or upper leg where single bones make restriction possible. The tourniquet should be released for 30 seconds every 20 minutes to allow fresh blood to enter the extremity.

REDDICK.

Only the **STATEMENT** of the steps of the procedure for first aid is given in this instructional sequence.

There is no **PRACTICE** REMEMBERING of the steps.

There is no **EXAMPLE** illustrating the procedure. The picture that is included helps the student identify the snake, not apply first aid.

3. If more than 1 hour is going to elapse before antivenom can be injected, TRAINED RESCUERS may employ incision and suction. With a sharp, sterile instrument (sterilized with a match if no other means is available) make two cuts, each not more than 1/2 inch long and 1/4 inch deep. The cuts should be made over the fang marks, lengthwise along the arm or leg. The incision must not injure tendons, muscles, blood vessels, or nerves. Suction may be performed by suction cup, if available, or by mouth and continued for at least 30 minutes. The sooner suction is started the better. If as much as an hour has passed since the bite was inflicted, incision and suction should not be used.

4. Antivenom should be given as soon as possible. This is best done by a physician because of difficulties that may arise from reactions to the serum. It should be administered as first aid only if medical assistance is not or will not be available and it is necessary to save the life of the victim.

5. Treat the victim for shock. Keep him lying down, make him as comfortable as possible, and keep him quiet. It may be necessary to give artificial respiration and cardiac massage. There are a number of cases on record where men have been kept alive as long as 2 hours after they became unconscious and have been saved by delayed injection of antivenom.

WHAT NOT TO DO: Morphine should not be given for pain when the venom is the type that affects the nervous system. Alcohol is forbidden—it speeds circulation. Ice packs and ice water should not be used—they have no proven value and may do considerable damage.

*There is no PRACTICE USING.
The steps are never performed.*

Example 2.

OBJECTIVE:

Given a calculator, the formula for capacitive reactance, $X_C = \frac{1}{2\pi fC}$ and a schematic with typical values for frequency and capacitance, the student will correctly calculate capacitive reactance in ohms to two decimal places.

TEST ITEM:

Use your calculator to solve for capacitive reactance $X_C = \frac{1}{2\pi fC}$ in ohms correct to two decimal places.

The values for frequency and capacitance are shown in the circuit below.

Task/Content

Classification:

Use-aided-Rule

Required

Presentation

Components:

You fill this in.

Completeness

Requirements:

You fill this in.

Example 2. Feedback

OBJECTIVE: Given a calculator, the formula for capacitive reactance, $X_C = \frac{1}{2\pi fC}$ and a schematic with typical values for frequency and capacitance, the student will correctly calculate capacitive reactance in ohms to two decimal places.

TEST ITEM: Use your calculator to solve for capacitive reactance, $X_C = \frac{1}{2\pi fC}$ in ohms correct to two decimal places.
The values for frequency and capacitance are shown in the circuit below.

Task/Content

Classification: Use-aided-Rule

Required

Presentation

Components:

The formula $X_C = \frac{1}{2\pi fC}$ is an Aid and replaces the statement.

Additional Fact objectives on the meaning of the symbols may need to be included as well as objectives on powers of ten and the math to use the formula. In this case we are assuming the student has recently encountered all symbols and can use the formula with only a brief review of facts he has learned recently.

Practice Remembering is not required.

The AID relieves the student of remembering the formula and should be available on the job.

Example showing how the formula is used to solve for the capacitive reactance of a circuit.

Practice Using the formula by calculating the capacitive reactance of several circuits.

Completeness
Requirements:

Examples: Illustrate the application of each step of formula to solve for capacitive reactance of a circuit.

Practice Using: The student should solve for capacitive reactance showing each step in the solution. Feedback must be given.

10-19. Capacitive Reactance

The definition of capacitance was stated as the ability to OPPOSE a change in applied voltage. It has been shown that when the applied voltage is changed the capacitor charges or discharges until the voltage on the capacitor is equal to the new value of applied voltage. At the time when the capacitor voltage is equal to the source voltage no more current flows. Since a capacitor reacts to a voltage change by producing a CEMF, a capacitor is said to be reactive. The opposition of a capacitor is therefore called REACTANCE (X) and is measured in ohms. In order to distinguish capacitive reactance from inductive reactance (X_L) the subscript c is added to the symbol X . The opposition offered by a capacitor to alternating current is termed CAPACITIVE REACTANCE and designated by X_c .

Although no current actually flows through a capacitor, CIRCUIT CURRENT will exist whenever a capacitor charges or discharges. If a capacitor is connected across an alternating voltage source, an alternating current will flow as the capacitor tries to charge and discharge in step with the voltage. If a sine wave of voltage is applied to a capacitor a sine wave of current will result. Since current in a capacitive circuit is maximum when the rate of change of voltage is maximum, the current waveform will be offset 90 degrees from the voltage waveform. This is illustrated in Figure 10-27A. Notice that when the voltage is passing through zero (maximum rate of change) the current is maximum. When the voltage is at its peak value (minimum rate of change) the current is zero, thus, IN A CAPACITIVE CIRCUIT THE CURRENT LEADS THE VOLTAGE BY 90 DEGREES. This phase relationship is shown vectorially in Figure 10-27B.

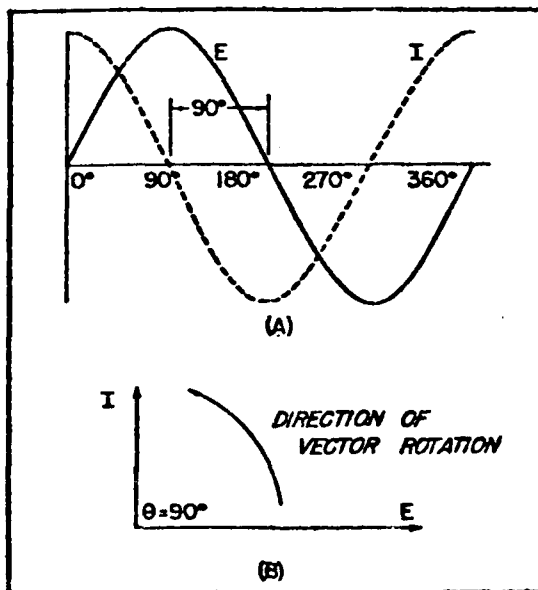


Figure 10-27 - Phase relations of E and I in a pure capacitive circuit.

YOUR COMMENTS

It was stated in Chapter 8, section 8-9 and 8-10, that a complete cycle (or rotation of 360 degrees) contains 2π radians and that radians per second is the unit of measure for angular velocity (ω). Expressed mathematically:

$$\omega = 2\pi f \quad (8-14)$$

Capacitive reactance is an inverse function of angular velocity and capacitance. Expressed mathematically:

$$X_C = \frac{1}{2\pi f C} \quad (10-24)$$

where: X_C = capacitive reactance in ohms

2π = a constant

f = frequency in cycles

C = capacitance in farads

Example. What is the capacitive reactance of a two microfarad capacitor at a frequency of 4 kilocycles?

Given: $2\pi = 6.28$

$f = 4$ kilocycles

$C = 2$ microfarads

Solution: $X_C = \frac{1}{2\pi f C} \quad (10-24)$

$$X_C = \frac{1}{6.28 (4 \times 10^3) (2 \times 10^{-6})}$$

$$X_C = 19.8 \text{ ohms}$$

30. Explain the meaning of capacitive reactance.
31. What effect does source frequency have on capacitive reactance?
32. Compute the capacitive reactance of a 100 picofarad capacitor at a frequency of 200 kilocycles.

10-19. Capacitive Reactance

The definition of capacitance was stated as the ability to OPPOSE a change in applied voltage. It has been shown that when the applied voltage is changed the capacitor charges or discharges until the voltage on the capacitor is equal to the new value of applied voltage. At the time when the capacitor voltage is equal to the source voltage no more current flows. Since a capacitor reacts to a voltage change by producing a CEMF, a capacitor is said to be reactive. The opposition of a capacitor is therefore called REACTANCE (X) and is measured in ohms. In order to distinguish capacitive reactance from inductive reactance (X_L) the subscript c is added to the symbol X . The opposition offered by a capacitor to alternating current is termed CAPACITIVE REACTANCE and designated by X_c .

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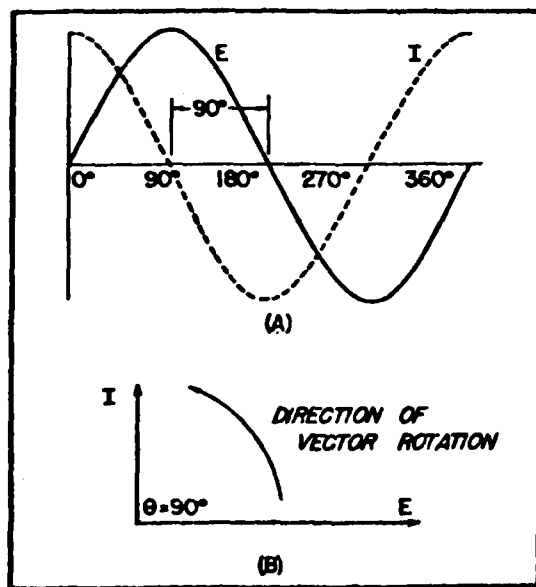


Figure 10-27 - Phase relations of E and I in a pure capacitive circuit.

The 1st paragraph contains the STATEMENT applying to a previous learning objective on recalling the definition of capacitive reactance. There is no PRACTICE REMEMBERING. However, that objective is not being evaluated here.

The 2nd paragraph contains a STATEMENT explaining how current acts in a capacitive circuit. There is no PRACTICE REMEMBERING. However, that objective is not being evaluated here either.

The instruction for the objective being evaluated in this example (calculating capacitive reactance) begins in paragraph 2 where the formula and explanation of the symbols are given. This can be classified as an introduction to the AIC, which replaces the usual STATEMENT and PRACTICE REMEMBERING components, when you have a use-aided item as we do here. However, if you look at the EXAMPLE you see that the student is required to remember the correct formula; it is not given to him. Therefore, the EXAMPLE is not consistent with the task level of the item. Also, the conditions of the objective require the student to read a schematic to find the values for the formula. The instruction here does not require the student to read a schematic.

These questions were included at the end of the chapter. Item 32 was probably intended as PRACTICE USING. However, it does not have the same task level or conditions as the test item, and no feedback is included for the item. Therefore, it is NOT CONSISTENT.

8-10, that a complete cycle (or rotation of 360 degrees) contains 2π radians and that radians per second is the unit of measure for angular velocity (ω). Expressed mathematically:

$$\omega = 2\pi f \quad (8-14)$$

Capacitive reactance is an inverse function of angular velocity and capacitance. Expressed mathematically:

$$X_c = \frac{1}{2\pi f C} \quad (10-24)$$

where: X_c = capacitive reactance in ohms

2π = a constant

f = frequency in cycles

C = capacitance in farads

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Given: $2\pi = 6.28$

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Solution: $X_c = \frac{1}{2\pi f C} \quad (10-24)$

$$X_c = \frac{1}{6.28 (4 \times 10^3) (2 \times 10^{-6})}$$

$$X_c = 19.8 \text{ ohms}$$

30. Explain the meaning of capacitive reactance.
31. What effect does source frequency have on capacitive reactance?
32. Compute the capacitive reactance of a 100 picofarad capacitor at a frequency of 200 kilocycles.

Example 3.

OBJECTIVE 1:

Given the name of any wrench listed below and a set of pictures of wrenches, the student will match the name to the appropriate picture. (open end, box end, slugging, combination, crescent, monkey, pipe, and strap.

TEST ITEM 1:

Column A lists names of wrenches. Column B shows pictures of wrenches found on the job. Look at the name for each wrench and match the correct picture to it.

A
List of Wrenches

- ☐ 1 crescent
- ☐ 2 open end
- ☐ 3 monkey
- ☐ 4 box end
- ☐ 5 pipe
- ☐ 6 slugging
- ☐ 7 strap
- ☐ 8 combination

B
Pictures of Wrenches

pictures of
10 wrenches

Task/Content
Classification:

Remember-Fact

You will notice this is a Remember Fact for RECOGNITION. The student must be familiar with the equipment, but on the job he will be in an apprentice level position and have constant supervision and feedback.

Required
Presentation
Components:

You fill this in.

Completeness
Requirements:

You fill this in.

OBJECTIVE 2:

Given the name of the wrenches listed above and functions of various wrenches, the student will match the name of the wrench to the correct function.

TEST ITEM 2:

Column A lists names of wrenches. Column B lists functions of various wrenches. Look at the name of each wrench and match the correct function to it.

A. Names of wrenches

- ☐ 1 crescent
- ☐ 2 open end
- ☐ 3 monkey
- ☐ 4 box end
- ☐ 5 pipe
- ☐ 6 slugging
- ☐ 7 strap
- ☐ 8 combination

B. The function of the wrench

- a.
- b.
- c.
- d.
- e.
- f.
- g.
- h.
- i.
- j.

**Task/Content
Classification:**

Remember-Fact

Again, here you see we are training for RECOGNITION (matching) rather than recall of the Facts. Much more time would be needed to train & test for recall of the functions from memory, and supervision and feedback are part of the job these apprentice level students will face later.

**Required
Presentation
Components:**

You fill this in.

**Completeness
Requirements:**

You fill this in.

OBJECTIVE 3:

The student will write in order the correct steps of a general procedure for using any wrench.

TEST ITEM 3:

Write the steps you need to follow when using any wrench.

Task/Content

Classification:

Remember-Procedure

Required
Presentation
Components:

You fill this in.

Completeness
Requirements:

You fill this in.

Example 3. Feedback

OBJECTIVE 1:

Given the name of any wrench listed below and a set of pictures of wrenches, the student will match the name to the appropriate picture. (open end, box end, slugging, combination, crescent, monkey, pipe, and strap)

TEST ITEM 1:

Column A lists names of wrenches. Column B shows pictures of wrenches found on the job. Look at the name for each wrench and match the correct picture to it.

A
List of Wrenches

- ☐ 1 Crescent
- ☐ 2 open end
- ☐ 3 monkey
- ☐ 4 box end
- ☐ 5 pipe
- ☐ 6 slugging
- ☐ 7 strap
- ☐ 8 combination

B
Pictures of Wrenches

pictures of
10 wrenches

Task/Content
Classification:

Remember-Fact

You will notice this is a Remember Fact for RECOGNITION. The student must be familiar with the equipment, but on the job he will be in an apprentice level position and have constant supervision and feedback.

OBJECTIVE 2:

Given the name of the wrenches listed above and functions of various wrenches, the student will match the name of the wrench to the correct function.

TEST ITEM 2:

Column A lists names of wrenches. Column B lists functions of various wrenches. Look at the name of each wrench and match the correct function to it.

A. Names of wrenches

- ___ 1 crescent
- ___ 2 open end
- ___ 3 monkey
- ___ 4 box end
- ___ 5 pipe
- ___ 6 slugging
- ___ 7 strap
- ___ 8 combination

B. The function of the wrench

- a.
- b.
- c.
- d.
- e.
- f.
- g.
- h.
- i.
- j.

Task/Content
Classification:

Remember-Fact

Again, here you see we are training for RECOGNITION (matching) rather than recall of the Facts. Much more time would be needed to train & test for recall of the functions from memory, and supervision and feedback are part of the job these apprentice level students will face later.

Required
Presentation
Components
for Objectives 1&2:

Statement of the facts to be remembered: when a wrench is named recognize what it looks like and what it's used for.

Practice Remembering the facts: match names to wrenches (or pictures) and to their function.

Completeness
Requirements
for Objectives 1&2:

Statement: Each wrench name in the objective should be listed with its picture and what it's used for.

Practice Remembering: Recognition of the wrenches and their functions, as in the test item, is required. Feedback must be present to be complete.

OBJECTIVE 3:	The student will write in order the correct steps of a general procedure for using any wrench.
TEST ITEM 3:	Write the steps you need to follow when using any wrench.
Task/Content Classification:	Remember-Procedure
Required Presentation Components:	<u>Statement</u> of the steps for use of any wrench. <u>Practice Remembering</u> the steps of the procedure.
Completeness Requirements:	<u>Statement</u> : All steps must be given in correct order. <u>Practice Remembering</u> : This must be like the test item, and feedback must be given.

EXAMPLE 3.

Instruction:

Note: Practice is at the end of the instruction. Pretend that the feedback is there because it is given by the CMI system. This instruction continues over the next 8 pages.

Narrative

One-2

YOUR COMMENTS

NARRATIVE
LESSON 2

HAND TOOLS

Introduction

When performing maintenance on machinery such as valves, pumps and steam turbines, operating engineers use wrenches, screwdrivers and pliers to remove and replace metal fasteners...the bolts, studs, nuts, and pins used to hold machinery together. As an engineer, you must have a knowledge of hand tools and their proper use because, without hand tools, maintenance of the machinery of an engineering propulsion plant is impossible. One mark of a professional operating engineer is his ability to select and use hand tools.

Different Types of Wrenches

The most common use for wrenches is to remove and replace nuts and bolts. In this lesson, you are going to learn about the following types of wrenches: open end, box end, combination, adjustable.

The wrench shown below is a double-ended, open-end wrench. It is so-called because each end of the wrench has an open slot which is fitted onto the "flats" of a nut or bolt.



DISTANCE ACROSS
FLATS



As shown in the diagram above, the openings of a wrench may be at an angle with the handle. This makes the wrench easier to use when there is limited space to "swing" the wrench. When an obstruction limits the turning space, more "swing" can be obtained by turning the wrench over prior to starting the next stroke.

Open-end wrenches have a tendency to slip off metal fasteners when they are being turned. The box-end wrench, shown below, overcomes this problem.



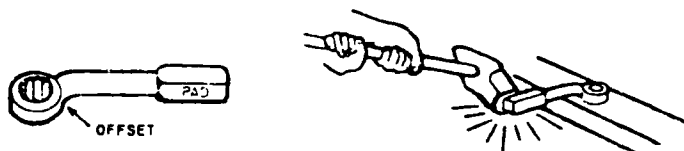
Unlike the open-end, the openings of a box-end wrench are made to fit over the corners or "points" of nuts and bolt heads. The size marked on each end of the wrench still refers to the distance between the flats of the metal fastener, however.

A box-end wrench has one fault...when there is limited turning space, it must be lifted off the nut or bolt at the end of each stroke. A combination wrench which has a box-end on one end and an open-end on the other overcomes this problem.

Combination wrenches are used as follows: First, the box-end is used to "break" loose the nut or bolt, then the ends are "swapped" and the open-end is used, because metal fasteners can be loosened (and tightened) faster with the open-end. Obviously, each end of a combination wrench will fit only one size nut or bolt.

To provide turning clearance over obstructions or other metal fasteners, box-end and combination wrenches are sometimes bent, or offset. The offset is similar to the slugging wrench offset below.

A single-ended, box-end wrench, called a "slugging" wrench, is sometimes used to loosen metal fasteners that hold the flanges of steam lines together. A slugging wrench has a pad on one end. It is the only wrench that is made to be struck with a hammer.



Here are three common-sense rules to follow when using a wrench...any kind of a wrench.

(1) Make sure the wrench fits the metal fastener. When the wrench is too large...does not fit snugly on the metal fastener...the wrench will slip and round off the corners of the bolt head or nut you are trying to loosen or tighten.

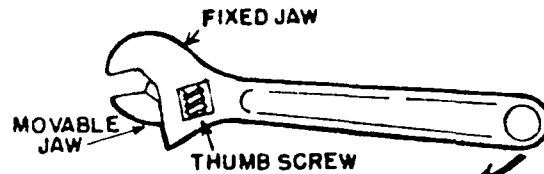
(2) PULL the wrench towards you...DON'T PUSH. When you push, and the wrench slips, or the metal fastener "breaks" loose, you can really skin up a good set of knuckles...YOURS! (NOTE: If pushing the wrench is the only way, do it with the open palm of your hand.)

YOUR COMMENTS

(3) Don't use too much force! When a metal fastener doesn't turn easily, the threads may be damaged, rusted, corroded or mismatched (wrong series). Too much force can also s-t-r-e-t-c-h the threads of a stud or bolt or shear the head off a bolt! In either case, a simple job can suddenly turn into a real headache! (NOTE: Rusty or corroded metal fasteners can sometimes be freed by applying penetrating oil. Let the fasteners "soak" a bit, then try loosening with a wrench.)

Different Types of Adjustable Wrenches

A useful tool, one which is all too often misused, is the adjustable, open-end wrench like the one shown below. NOTE: This tool is commonly called a "crescent" wrench. Here's how it works: By turning the thumb screw, the size of the opening between the jaws can be changed to fit a wide range of sizes of metal fasteners and other fittings.



CAUTION: When using an adjustable open-end wrench, the thumbscrew must be adjusted to cause the jaws to fit snugly against the flats of the metal fastener. If this isn't done, the "play" between the thumbscrew and the moveable jaw may cause the wrench to slip...and round off the corners of bolts and nuts.

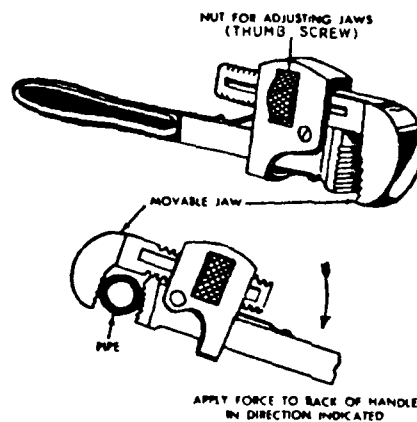
Another type of adjustable wrench, one with smooth jaws, is known as a "monkey" wrench. (It was invented by a guy named Monke.)



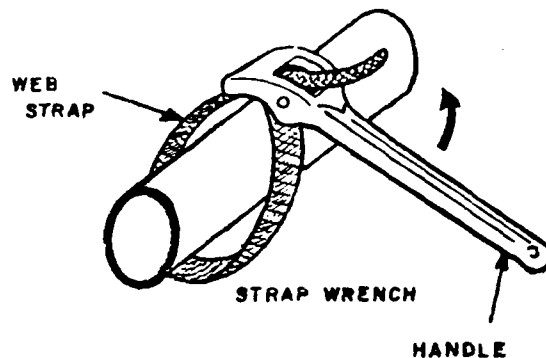
This wrench is preferred for use on large metal fasteners and fittings because the jaws are wider and stronger. A monkey wrench also fits a wider range of sizes than an adjustable open-end wrench of the same length.

An adjustable wrench that resembles a monkey wrench is the pipe wrench shown below. It has a fixed and a moveable jaw with teeth that bite into threaded iron pipe and pipe fittings. (This wrench may also be called a "Stillson.")

Never, never use a pipe wrench when the job calls for a wrench with smooth jaws! The teeth in the jaws of a pipe wrench will damage the surface of metal fasteners and fittings.



When it is necessary to turn a cylinder which has a smooth surface, such as the drive shaft of a pump, use a strap wrench like the one shown below.



The web strap is pulled through the opening in the handle until the strap fits snugly around the shaft. Pulling on the handle in the direction shown by the arrow will cause the strap to tighten, and increase the friction between the strap and the shaft. The shaft should turn.

MODULE ONE
LESSON 2

HAND TOOLS

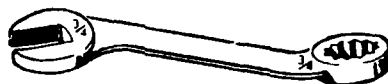
1. Using the List of Tools, write the name of each tool in the blank by the number of each diagram.

List of Tools

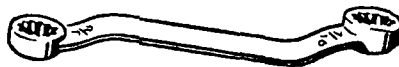
COMBINATION WRENCH
SLUGGING WRENCH
DOUBLE-ENDED BOX END WRENCH
DOUBLE-ENDED OPEN END WRENCH



1. _____



2. _____



3. _____



4. _____

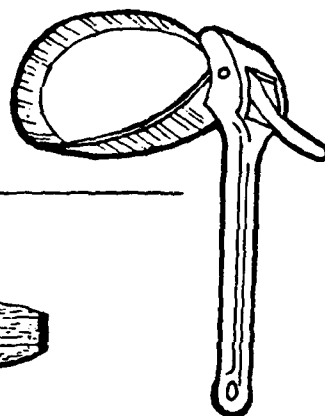
2. Using the diagrams above, write the number of the wrench best described by each statement, in the blank before each statement.

- _____ a. Each end fits over the "points" of a metal fastener.
- _____ b. Each end fits over the "flats" of a metal fastener.
- _____ c. Each end is made to fit one size of a metal fastener.
- _____ d. This wrench is made to be struck with a hammer.

3. Using the List of Tools, write the name of each wrench in the blank by the number of each diagram.

List of Tools

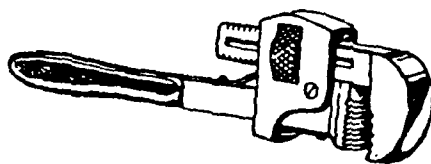
PIPE WRENCH
STRAP WRENCH
MONKEY WRENCH
ALLEN WRENCH
ADJUSTABLE, OPEN-END
WRENCH
COMBINATION WRENCH



1. _____



2. _____



3. _____



4. _____

YOUR COMMENTS

4. Using the diagrams on the opposite page, write the number of the tool or tools best described by each statement, in the blank before each statement
- ___ a. Its jaws have teeth for the purpose of biting into metal pipe.
 - ___ b. The size of the jaw opening of these wrenches is adjusted by turning a thumb-screw or a thumb nut.
 - ___ c. It is commonly known as a "crescent" wrench.
 - ___ d. These wrenches have smooth jaws that fit on the flats of metal fasteners and fittings.
 - ___ e. It is used to turn smooth cylinders or shafts without damaging their surfaces.
5. When using a wrench, you should always try to _____ the wrench _____ you.
(push/pull) (away from/toward)
6. When too much force is used to tighten threaded metal fasteners, the threads may be _____ and bolt heads may _____ off.

EXAMPLE 3. Consistency Feedback

Narrative

One-2

FEEDBACK

NARRATIVE LESSON 2

HAND TOOLS

Introduction

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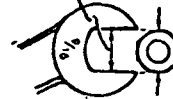
FEEDBACK

This is the STATEMENT for open-end wrenches and a picture is included. However, the use of the wrench is not clear.

The wrench shown below is a double-ended, open-end wrench. It is so-called because each end of the wrench has an open slot which is fitted onto the "flats" of a nut or bolt.



DISTANCE ACROSS
FLATS



As shown in the diagram above, the openings of a wrench may be at an angle with the handle. This makes the wrench easier to use when there is limited space to "swing" the wrench. When an obstruction limits the turning space, more "swing" can be obtained by turning the wrench over prior to starting the next stroke.

Open-end wrenches have a tendency to slip off metal fasteners when they are being turned. The box-end wrench, shown below, overcomes this problem.



This is the STATEMENT for box-end wrenches. A picture of the wrench is included and its function is stated.

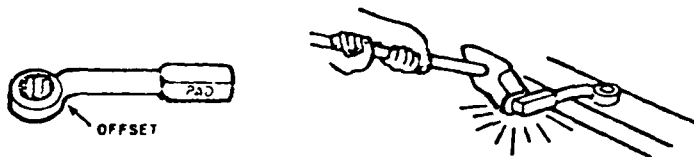
Unlike the open-end, the openings of a box-end wrench are made to fit over the corners or "points" of nuts and bolt heads. The size marked on each end of the wrench still refers to the distance between the flats of the metal fastener, however.

A box-end wrench has one fault...when there is limited turning space, it must be lifted off the nut or bolt at the end of each stroke. A combination wrench which has a box-end on one end and an open-end on the other overcomes this problem.

Combination wrenches are used as follows: First, the box-end is used to "break" loose the nut or bolt, then the ends are "swapped" and the open-end is used, because metal fasteners can be loosened (and tightened) faster with the open-end. Obviously, each end of a combination wrench will fit only one size nut or bolt.

To provide turning clearance over obstructions or other metal fasteners, box-end and combination wrenches are sometimes bent, or offset. The offset is similar to the slugging wrench offset below.

A single-ended, box-end wrench, called a "slugging" wrench, is sometimes used to loosen metal fasteners that hold the flanges of steam lines together. A slugging wrench has a pad on one end. It is the only wrench that is made to be struck with a hammer.



Here are three common-sense rules to follow when using a wrench...any kind of a wrench.

(1) Make sure the wrench fits the metal fastener. When the wrench is too large...does not fit snugly on the metal fastener...the wrench will slip and round off the corners of the bolt head or nut you are trying to loosen or tighten.

(2) PULL the wrench towards you...DON'T PUSH. When you push, and the wrench slips, or the metal fastener "breaks" loose, you can really skin up a good set of knuckles...YOURS! (NOTE: If pushing the wrench is the only way, do it with the open palm of your hand.)

This is the STATEMENT for the combination wrench. However, it is not complete because there is no illustration of the wrench. Its use is given.

This is the STATEMENT for the slugging wrench. Both the picture and the specific use of the wrench are given.

Here is the STATEMENT for the steps of how to use a wrench. However, it is not complete; not all the steps are given.

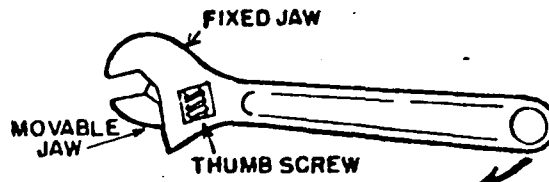
Here is the STATEMENT relating to the crescent wrench. Its use and a picture illustration are included.

This is the STATEMENT for the monkey wrench- the picture and function are stated.

(3) Don't use too much force! When a metal fastener doesn't turn easily, the threads may be damaged, rusted, corroded or mismatched (wrong series). Too much force can also s-t-r-e-t-c-h the threads of a stud or bolt or shear the head off a bolt! In either case, a simple job can suddenly turn into a real headache! (NOTE: Rusted or corroded metal fasteners can sometimes be freed by applying penetrating oil. Let the fasteners "soak" a bit, then try loosening with a wrench.)

Different Types of Adjustable Wrenches

A useful tool, one which is all too often misused, is the adjustable, open-end wrench like the one shown below. NOTE: This tool is commonly called a "crescent" wrench. Here's how it works: By turning the thumbscrew, the size of the opening between the jaws can be changed to fit a wide range of sizes of metal fasteners and other fittings.



CAUTION: When using an adjustable open-end wrench, the thumbscrew must be adjusted to cause the jaws to fit snugly against the flats of the metal fastener. If this isn't done, the "play" between the thumbscrew and the moveable jaw may cause the wrench to slip...and round off the corners of bolts and nuts.

Another type of adjustable wrench, one with smooth jaws, is known as a "monkey" wrench. (It was invented by a guy named Monke.)

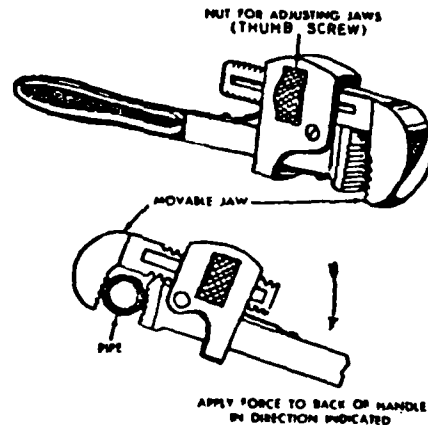


This wrench is preferred for use on large metal fasteners and fittings because the jaws are wider and stronger. A monkey wrench also fits a wider range of sizes than an adjustable open-end wrench of the same length.

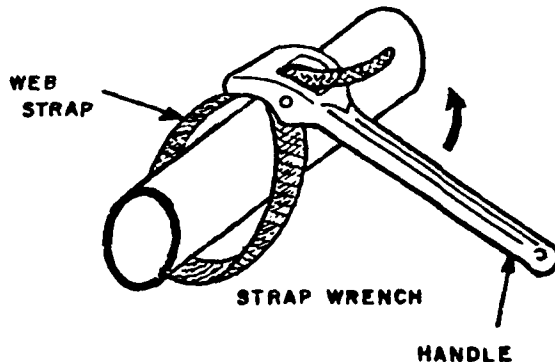
FEEDBACK

An adjustable wrench that resembles a monkey wrench is the pipe wrench shown below. It has a fixed and a moveable jaw with teeth that bite into threaded iron pipe and pipe fittings. (This wrench may also be called a "Stillson.")

Never, never use a pipe wrench when the job calls for a wrench with smooth jaws! The teeth in the jaws of a pipe wrench will damage the surface of metal fasteners and fittings.



When it is necessary to turn a cylinder which has a smooth surface, such as the drive shaft of a pump, use a strap wrench like the one shown below.



The web strap is pulled through the opening in the handle until the strap fits snugly around the shaft. Pulling on the handle in the direction shown by the arrow will cause the strap to tighten, and increase the friction between the strap and the shaft. The shaft should turn.

This is the STATEMENT for the pipe or Stillson wrench. It is complete.

Here is the STATEMENT for the strap wrench. The statement is complete.

FEEDBACK

Item 1. This is PRACTICE REMEMBERING for objective 1. Since both the names and the pictures are given it is a recognition task and is consistent with the type of task specified by the objective. However, the format does not exactly duplicate the test item. Also, only four of the eight wrenches are given here.

Item 2. This is supposed to be a PRACTICE REMEMBERING for the procedure of how each wrench is used. However, it does not test all the information specified by the test item for objective 3: It is not complete. The format is different. Recognition is inappropriate for a Remember Procedure classification.

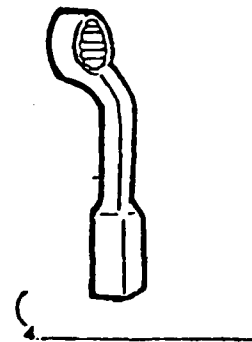
MODULE ONE LESSON 2

HAND TOOLS

1. Using the List of Tools, write the name of each tool in the blank by the number of each diagram.

List of Tools

COMBINATION WRENCH
SLUGGING WRENCH
DOUBLE-ENDED BOX END WRENCH
DOUBLE-ENDED OPEN END WRENCH



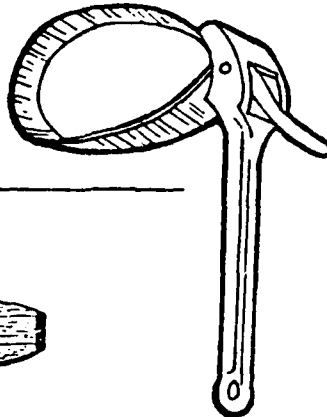
2. Using the diagrams above, write the number of the wrench best described by each statement, in the blank before each statement.

- ___ a. Each end fits over the "points" of a metal fastener.
- ___ b. Each end fits over the "flats" of a metal fastener.
- ___ c. Each end is made to fit one size of a metal fastener.
- ___ d. This wrench is made to be struck with a hammer.

3. Using the List of Tools, write the name of each wrench in the blank by the number of each diagram.

List of Tools

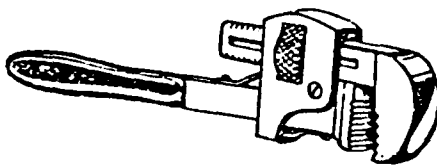
PIPE WRENCH
STRAP WRENCH
MONKEY WRENCH
ALLEN WRENCH
ADJUSTABLE, OPEN-END
WRENCH
COMBINATION WRENCH



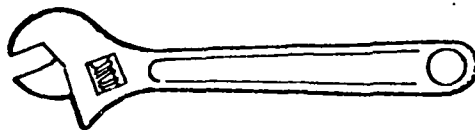
1. _____



2. _____



3. _____



4. _____

This is another PRACTICE REMEMBERING for objective 1. Although it is a recognition level item for the Remember Fact classification, the action is not the same. In this case the student must look at a picture of a wrench and match the correct name from a list of choices.

FEEDBACK

Item 4 is intended as a PRACTICE REMEMBERING. Two of the descriptions (a and e) test objective 2; match the function to the name. The conditions are not consistent, though, since the student is to use the pictures to choose from.

Two of the descriptions (b and d) test how to use the wrench (objective 3). The same comments that were made for item 2 above apply here. One description (c) tests objective 1 and is consistent. Items 5 and 6 are to be PRACTICE REMEMBERING for objective 3; rules on how to use a wrench, but are a fill-in format when a listing format is required for the test. Also it only tests part of the information.

CONSISTENCY SUMMARY

STATEMENTS:

Statements were present but not always complete. For objective 1 and 2 statements were not complete in one of the eight instances for each objective. A complete statement of all the steps was never given for objective 3.

PRACTICE REMEMBERING:

In objective 1 practice remembering was present and complete in that the item format was a recognition level, but the action required in the practice and the test items were not consistent. All wrenches were sampled. In objective 2, practice items on wrenches were not adequately sampled. The practice was recognition, as the objective required, but the conditions of the practice were inconsistent with the conditions specified by the objective and the test item. In objective 3, the practice format was inconsistent with the objective and test item. A fill-in format appeared in the practice while a listing format is specified by the objective. We specified at the beginning that the CMI system supplied feedback for the practice, so it can be counted as present.

4. Using the diagrams on the opposite page, write the number of the tool or tools best described by each statement, in the blank before each statement.
 - ___ a. Its jaws have teeth for the purpose of biting into metal pipe.
 - ___ b. The size of the jaw opening of these wrenches is adjusted by turning a thumb-screw or a thumb nut.
 - ___ c. It is commonly known as a "crescent" wrench.
 - ___ d. These wrenches have smooth jaws that fit on the flats of metal fasteners and fittings.
 - ___ e. It is used to turn smooth cylinders or shafts without damaging their surfaces.
5. When using a wrench, you should always try to _____ the wrench _____ you.
(push/pull) (away from/toward)
6. When too much force is used to tighten threaded metal fasteners, the threads may be _____ and bolt heads may _____ off.

Chapter 5

PRESENTATION ADEQUACY

Introduction

In the last chapter, the consistency of the instructional presentation with objectives and test items was assessed. That is, the presentation was checked to make sure that the right combination of instructional components was present. This chapter is concerned with the adequacy of the instructional components.

Instruction can be consistent, but still not teach as effectively as it could. The adequacy procedures incorporate a number of instructional design principles which have been shown to promote student learning. These include guidelines for formatting information so students can find it, for communicating it clearly and effectively so students can understand it, and for including additional explanation, so students can better learn and remember the information.

On the next two pages, the PRESENTATION ADEQUACY procedures from Volume IV are presented, followed by the three presentations. Use the procedures to evaluate them for adequacy. Feedback follows each presentation. Additional explanation of the procedure is given in Volume II.



INSTRUCTIONAL
QUALITY
INVENTORY

PRESENTATION ADEQUACY

CARD 5

STEP 1: DETERMINE whether or not each required PRESENTATION COMPONENT meets the general ADEQUACY criteria below.

SEPARATED: Statements, Examples, or Practice must be SEPARATED from the rest of the instruction. *There are different ways components may be separated:*

- Set off the component with a box.
- Use a different color or type face, or underline.
- Place on a separate page, or in a special place on the page.
- For audio, movies, or lectures, pause before introducing the component.

IDENTIFIED: Statements, Examples, and Practice must be IDENTIFIED so the student knows what they are, and can locate them. *Labels can be used to identify different components:*

Definition of ...	Example	Practice
Procedure for ...	Demonstration	Test Yourself
Key Point:		

CLEARLY STATED: Statements, Examples, and Practice must be CLEARLY STATED so the student can understand them. *The following criteria should be used:*

- The READING LEVEL must be appropriate for the students.
- The presentation should not be confusing, vague, or too wordy.
- All essential information should be present; the student should not be referred to other places to obtain information.
- All presentations should be PERFORMANCE-ORIENTED, not topic-oriented.

STEP 2: DETERMINE whether or not each required PRESENTATION COMPONENT meets the specific ADEQUACY criteria below:

STATEMENTS: HELP: In addition to the statement, the instruction should include something to help the student better understand and remember the statement. *Methods of providing help include:*

- Giving a MNEMONIC (memory trick) or other memory aid.
- Representing the statement with pictures, symbols, flowcharts, etc.
- Explaining how the statement relates to something the student already knows, how it fits in the course, why it is important.
- Giving more explanation about what the statement means.

CLEARLY STATED: In addition to the criteria above, statements for different content types must meet the criteria below:

CATEGORIES: Give a decision rule or search strategy for classification.
PROCEDURES: Each step should have only one action.
RULES: If a formula is used, symbols must be defined.

(Continued on other side)

EXAMPLES:	HELP:	Examples should include additional information to help the student understand. <i>Some types of HELP for different CONTENT TYPES are given below:</i>
		<p>HELP for CATEGORIES: Highlight critical characteristics. Explain the reasons for classification. Illustrate the use of the decision rule or search strategy.</p> <p>HELP for PROCEDURES or RULES: Explain the steps. Give more information on how to perform each step. Give a demonstration of each step. Give flowcharts, tables, etc.</p> <p>HELP for PRINCIPLES: Highlight important causes, effects, relationships. Give additional information about how the principle applies, or why it doesn't.</p>
	MATCHING: (categories only):	Examples should be matched with non-examples according to the presence and absence of each critical characteristic.
	EASY to HARD:	Early examples should be simplified. Conditions and standards may be relaxed on early examples so the student can learn gradually.
	ENOUGH EXAMPLES:	There should be enough examples to cover the content area thoroughly. For CATEGORIES: At least one example-nonexample pair for each critical characteristic. For PROCEDURES or RULES: One example for each important step. examples for all possible branches or decisions.
	COMMON ERRORS:	Examples should show why common errors are wrong.
PRACTICE REMEMBERING or PRACTICE USING:	FREE OF HINTS:	The practice items should not include anything that won't appear on the test, or on the job.
	EASY to HARD:	(USING only) Early practice items may be simplified, or conditions and standards may be relaxed. Final practice items should be typical of the job.
	COMMON ERRORS:	(USING only) Practice should include the opportunity for common errors, so they can be corrected.
	ENOUGH PRACTICE:	There should be enough practice so the student has an adequate opportunity to learn. For CATEGORIES: Practice for presence or absence of all critical characteristics. For PROCEDURES or RULES: Practice for all possible branches or decisions.
	FEEDBACK:	The FEEDBACK must be <u>SEPARATED</u> and <u>IDENTIFIED</u> .
	FEEDBACK HELP:	The FEEDBACK should include HELP like the help for examples.

PRESENTATION ADEQUACY PRACTICE

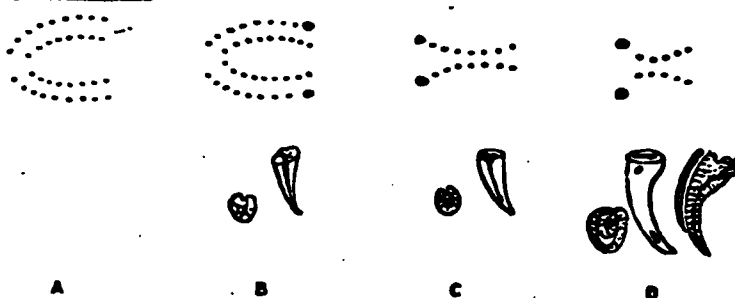
The instructional presentations from the last chapter are repeated in this section. This time you will rate them for adequacy. For each example, you will determine if (1) the presentation components are separated, identified, and clearly stated, (2) help is given, and (3) examples and practice are adequate. Again, the feedback about adequacy will be given *in italics* in the margins. After the examples, a revised version of each of the instructional presentations is included. The revised versions will be consistent and adequate.

The objectives and test items for these examples are given in the previous chapter and are not repeated here.

EXAMPLE 1.
Instruction:

YOUR COMMENTS

Snakebite:



Identification of Snakes by Bite Impressions. A, nonpoisonous, no fangs, family Colubridae subfamily Colubrinae (U.S. garter snake, European ringed snake, black snake); B, poisonous, posterior fangs, fangs not hollow but grooved slightly, family Colubridae subfamily Boiginae (boomslang of Africa); C, poisonous, anterior fangs, fangs relatively short, deeply grooved, family Elapidae (krait, mamba, water cobra, cobra, and coral snakes) and family Hydrophidae (sea snakes); D, poisonous, anterior fangs markedly separated from teeth, fangs long, relatively large, and completely hollow, family Viperidae (horned, sand, and tree vipers, puff-adders), family Crotalidae (rattlesnakes, copperheads, water moccasins, fer-de-lance).

Figure 5-2.—Identification of snakes by bite impressions.

Treatment.—The first advice to give the snakebite victim is that he lie down and keep calm. Remind him that of those bitten, few die or are even disabled, if certain principles are followed. Since the identity of the snake is important in the selection of the antivenom, kill the snake (a sharp blow on the head is the best method) and, with a stick, examine the mouth for fangs. Fix the color and color pattern in mind and note the general appearance of the snake. (Unfortunately, most snakebites occur between twilight and daybreak when snakes are most active and identification most difficult. Identification in these situations can only be made by analyzing the symptoms.)

The following rules of first aid should be observed:

1. Immediately put the victim at rest and immobilize the affected part below the level of the heart. Keep him dry, warm, and quiet. Transportation should be by litter when possible.

2. When the bite is on the arm or leg, place a tourniquet 2 to 4 inches closer to the heart than the site of the bite. The tourniquet should be tight enough to stop the flow of blood in the veins but not in arteries. **EXCEPTION:** If the bite occurs in Africa, India, Burma, Thailand, or Australia where venoms that affect the nervous system are to be expected, or if the snake is positively identified as one possessing this type of venom, the tourniquet should be tight enough to restrict arterial flow and should be placed on the upper arm or upper leg where single bones make restriction possible. The tourniquet should be released for 30 seconds every 20 minutes to allow fresh blood to enter the extremity.

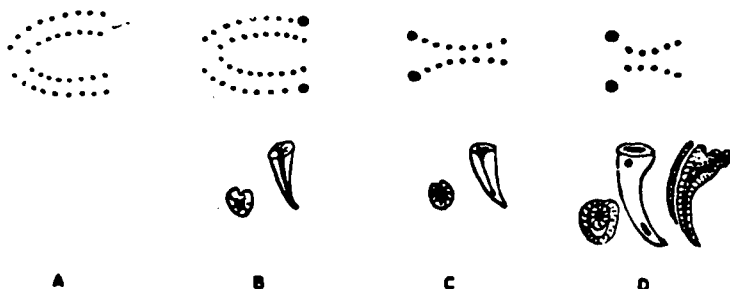
3. If more than 1 hour is going to elapse before antivenom can be injected, TRAINED RESCUERS may employ incision and suction. With a sharp, sterile instrument (sterilized with a match if no other means is available) make two cuts, each not more than 1/2 inch long and 1/4 inch deep. The cuts should be made over the fang marks, lengthwise along the arm or leg. The incision must not injure tendons, muscles, blood vessels, or nerves. Suction may be performed by suction cup, if available, or by mouth and continued for at least 30 minutes. The sooner suction is started the better. If as much as an hour has passed since the bite was inflicted, incision and suction should not be used.

4. Antivenom should be given as soon as possible. This is best done by a physician because of difficulties that may arise from reactions to the serum. It should be administered as first aid only if medical assistance is not or will not be available and it is necessary to save the life of the victim.

5. Treat the victim for shock. Keep him lying down, make him as comfortable as possible, and keep him quiet. It may be necessary to give artificial respiration and cardiac massage. There are a number of cases on record where men have been kept alive as long as 2 hours after they became unconscious and have been saved by delayed injection of antivenom.

WHAT NOT TO DO: Morphine should not be given for pain when the venom is the type that affects the nervous system. Alcohol is forbidden—it speeds circulation. Ice packs and ice water should not be used—they have no proven value and may do considerable damage.

Snakebite:



Identification of Snakes by Bite Impressions. A, nonpoisonous, no fangs, family Colubridae subfamily Colubrinae (U.S. garter snake, European ringed snake, black snake); B, poisonous, posterior fangs, fangs not hollow but grooved slightly, family Colubridae subfamily Boiginae (boomslang of Africa); C, poisonous, anterior fangs, fangs relatively short, deeply grooved, family Elapidae (kraits, mambas, water cobras, cobras, and coral snakes) and family Hydrophiidae (sea snakes); D, poisonous, anterior fangs markedly separated from teeth, fangs long, relatively large, and completely hollow, family Viperidae (horned, sand, and tree vipers, puff adders), family Crotalidae (rattlesnakes, copperheads, water moccasins, fer-de-lance)

Figure 5-2.—Identification of snakes by bite impressions.

Treatment.—The first advice to give the snakebite victim is that he lie down and keep calm. Remind him that of those bitten, few die or are even disabled, if certain principals are followed. Since the identity of the snake is important in the selection of the antivenom, kill the snake (a sharp blow on the head is the best method) and, with a stick, examine the mouth for fangs. Fix the color and color pattern in mind and note the general appearance of the snake. (Unfortunately, most snakebites occur between twilight and daybreak when snakes are most active and identification most difficult. Identification in these situations can only be made by analyzing the symptoms.)

The following rules of first aid should be observed:

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The STATEMENT is separated & identified, but is not clearly stated. Steps are listed, but the presentation is wordy. There is more than one action per step. There is no help for the statement, and there are no instructions to the student about what to learn.

There is no Practice Remembering, so adequacy cannot be evaluated.

There are no EXAMPLES given in this sequence.

There should be a demonstration illustrating each important step or pictures of each step. The placing & tightness of the tourniquet can best be demonstrated with explanation about important points to be aware of. Also, the incision step should be illustrated.

3. If more than 1 hour is going to elapse before antivenom can be injected, TRAINED RESCUERS may employ incision and suction. With a sharp, sterile instrument (sterilized with a match if no other means is available) make two cuts, each not more than 1/2 inch long and 1/4 inch deep. The cuts should be made over the fang marks, lengthwise along the arm or leg. The incision must not injure tendons, muscles, blood vessels, or nerves. Suction may be performed by suction cup, if available, or by mouth and continued for at least 30 minutes. The sooner suction is started the better. If as much as an hour has passed since the bite was inflicted, incision and suction should not be used.

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5. Treat the victim for shock. Keep him lying down, make him as comfortable as possible, and keep him quiet. It may be necessary to give artificial respiration and cardiac massage. There are a number of cases on record where men have been kept alive as long as 2 hours after they became unconscious and have been saved by delayed injection of antivenom.

WHAT NOT TO DO: Morphine should not be given for pain when the venom is the type that affects the nervous system. Alcohol is forbidden—it speeds circulation. Ice packs and ice water should not be used—they have no proven value and may do considerable damage.

The PRACTICE USING is not present, but its adequacy depends on the instructor watching each step & giving feedback for each. Using this instruction, the student never has a chance to practice the first aid skill.

Instruction:

10-19. Capacitive Reactance

The definition of capacitance was stated as the ability to OPPOSE a change in applied voltage. It has been shown that when the applied voltage is changed the capacitor charges or discharges until the voltage on the capacitor is equal to the new value of applied voltage. At the time when the capacitor voltage is equal to the source voltage no more current flows. Since a capacitor reacts to a voltage change by producing a CEMF, a capacitor is said to be reactive. The opposition of a capacitor is therefore called REACTANCE (X) and is measured in ohms. In order to distinguish capacitive reactance from inductive reactance (X_L) the subscript c is added to the symbol X . The opposition offered by a capacitor to alternating current is termed CAPACITIVE REACTANCE and designated by X_c .

Although no current actually flows through a capacitor, CIRCUIT CURRENT will exist whenever a capacitor charges or discharges. If a capacitor is connected across an alternating voltage source, an alternating current will flow as the capacitor tries to charge and discharge in step with the voltage. If a sine wave of voltage is applied to a capacitor a sine wave of current will result. Since current in a capacitive circuit is maximum when the rate of change of voltage is maximum, the current waveform will be offset 90 degrees from the voltage waveform. This is illustrated in Figure 10-27A. Notice that when the voltage is passing through zero (maximum rate of change) the current is maximum. When the voltage is at its peak value (minimum rate of change) the current is zero, thus, IN A CAPACITIVE CIRCUIT THE CURRENT LEADS THE VOLTAGE BY 90 DEGREES. This phase relationship is shown vectorially in Figure 10-27B.

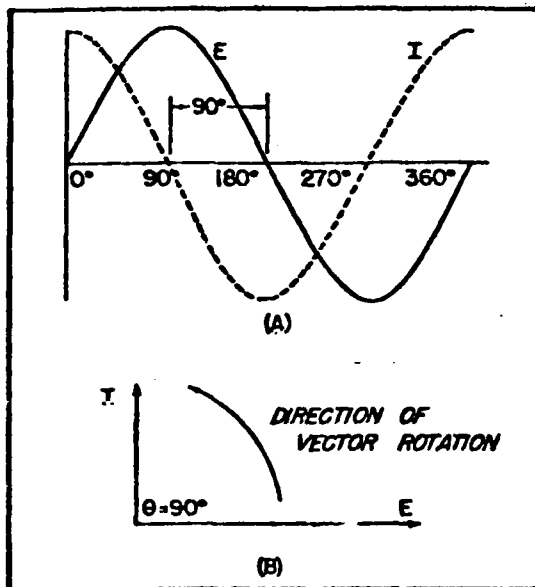


Figure 10-27 - Phase relations of E and I in a pure capacitive circuit.

YOUR COMMENTS

YOUR COMMENTS

It was stated in Chapter 8, section 8-9 and 8-10, that a complete cycle (or rotation of 360 degrees) contains 2π radians and that radians per second is the unit of measure for angular velocity (ω). Expressed mathematically:

$$\omega = 2\pi f \quad (8-14)$$

Capacitive reactance is an inverse function of angular velocity and capacitance. Expressed mathematically:

$$X_c = \frac{1}{2\pi f C} \quad (10-24)$$

where: X_c = capacitive reactance in ohms

2π = a constant

f = frequency in cycles

C = capacitance in farads

Example. What is the capacitive reactance of a two microfarad capacitor at a frequency of 4 kilocycles?

Given: $2\pi = 6.28$

$f = 4$ kilocycles

$C = 2$ microfarads

Solution: $X_c = \frac{1}{2\pi f C} \quad (10-24)$

$$X_c = \frac{1}{6.28 (4 \times 10^3) (2 \times 10^{-6})}$$

$$X_c = 19.8 \text{ ohms}$$

30. Explain the meaning of capacitive reactance.
31. What effect does source frequency have on capacitive reactance?
32. Compute the capacitive reactance of a 100 picofarad capacitor at a frequency of 200 kilocycles.

10-19. Capacitive Reactance

The definition of capacitance was stated as the ability to OPPOSE a change in applied voltage. It has been shown that when the applied voltage is changed the capacitor charges or discharges until the voltage on the capacitor is equal to the new value of applied voltage. At the time when the capacitor voltage is equal to the source voltage no more current flows. Since a capacitor reacts to a voltage change by producing a CEMF, a capacitor is said to be reactive. The opposition of a capacitor is therefore called REACTANCE (X) and is measured in ohms. In order to distinguish capacitive reactance from inductive reactance (X_L) the subscript c is added to the symbol X . The opposition offered by a capacitor to alternating current is termed CAPACITIVE REACTANCE and designated by X_c .

Although no current actually flows through a capacitor, CIRCUIT CURRENT will exist whenever a capacitor charges or discharges. If a capacitor is connected across an alternating voltage source, an alternating current will flow as the capacitor tries to charge and discharge in step with the voltage. If a sine wave of voltage is applied to a capacitor a sine wave of current will result. Since current in a capacitive circuit is maximum when the rate of change of voltage is maximum, the current waveform will be offset 90 degrees from the voltage waveform. This is illustrated in Figure 10-27A. Notice that when the voltage is passing through zero (maximum rate of change) the current is maximum. When the voltage is at its peak value (minimum rate of change) the current is zero, thus, IN A CAPACITIVE CIRCUIT THE CURRENT LEADS THE VOLTAGE BY 90 DEGREES. This phase relationship is shown vectorially in Figure 10-27B.

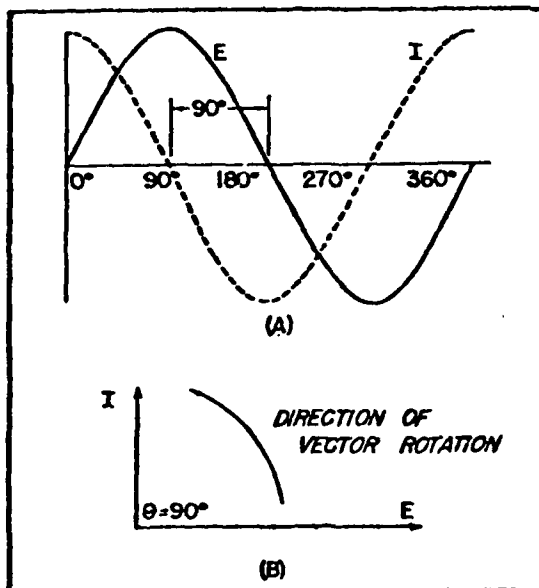


Figure 10-27 - Phase relations of E and I in a pure capacitive circuit.

Although we are not specifically evaluating the instruction given here, the STATEMENTS are not clearly separated and identified. Some parts of them are emphasized by capitalization. The introduction should be performance oriented. The student should be told what he needs to learn and how it will be used on the job.

The diagram is a HELP for the STATEMENT and is well separated and identified. The student should have previous experience reading diagrams of this type so that the diagram can meet the "clearly stated" criteria.

FEEDBACK

The AID, formula for capacitive reactance, is given and all symbols are identified. There should have been a previous Remember Fact objective for the symbols to make the formula meaningful and usable immediately by the student.

Although adequacy is not usually evaluated when the consistency criteria are not met, the EXAMPLE is separated and identified. However, the steps in the mathematical solution should be simplified and broken down into smaller steps. HELPs explaining the steps could be added. (There should be previous enabling objectives training the student on using powers of ten and the math associated with it, and also an objective for remembering what the prefixes mean: μ = micro = 10^{-6} and k = kilo = 10^3 .)

The PRACTICE USING was not consistent either and cannot be evaluated for adequacy. However, there should be more than one practice item and the early ones should be fairly simple mathematically, while final item values should be typical of the level of difficulty found on the job.

It was stated in Chapter 8, section 8-9 and 8-10, that a complete cycle (or rotation of 360 degrees) contains 2π radians and that radians per second is the unit of measure for angular velocity (ω). Expressed mathematically:

$$\omega = 2\pi f \quad (8-14)$$

Capacitive reactance is an inverse function of angular velocity and capacitance. Expressed mathematically:

$$X_c = \frac{1}{2\pi f C} \quad (10-24)$$

where: X_c = capacitive reactance in ohms

2π = a constant

f = frequency in cycles

C = capacitance in farads

Example. What is the capacitive reactance of a two microfarad capacitor at a frequency of 4 kilocycles?

Given: $2\pi = 6.28$

$f = 4$ kilocycles

$C = 2$ microfarads

Solution: $X_c = \frac{1}{2\pi f C} \quad (10-24)$

$$X_c = \frac{1}{6.28 (4 \times 10^3) (2 \times 10^{-6})}$$

$X_c = 19.8$ ohms

30. Explain the meaning of capacitive reactance.
31. What effect does source frequency have on capacitive reactance?
32. Compute the capacitive reactance of a 100 picofarad capacitor at a frequency of 200 kilocycles.

EXAMPLE 3.

Instruction:

Note: Practice is at the end of the instruction. Pretend that the feedback is there because it is given by the CMI system. This instruction continues over the next 8 pages.

YOUR COMMENTS

Narrative

One -2

NARRATIVE
LESSON 2

HAND TOOLS

Introduction

When performing maintenance on machinery such as valves, pumps and steam turbines, operating engineers use wrenches, screwdrivers and pliers to remove and replace metal fasteners...the bolts, studs, nuts, and pins used to hold machinery together. As an engineer, you must have a knowledge of hand tools and their proper use because, without hand tools, maintenance of the machinery of an engineering propulsion plant is impossible. One mark of a professional operating engineer is his ability to select and use hand tools.

Different Types of Wrenches

The most common use for wrenches is to remove and replace nuts and bolts. In this lesson, you are going to learn about the following types of wrenches: open end, box end, combination, adjustable.

YOUR COMMENTS

The wrench shown below is a double-ended, open-end wrench. It is so-called because each end of the wrench has an open slot which is fitted onto the "flats" of a nut or bolt.



DISTANCE ACROSS
FLATS



As shown in the diagram above, the openings of a wrench may be at an angle with the handle. This makes the wrench easier to use when there is limited space to "swing" the wrench. When an obstruction limits the turning space, more "swing" can be obtained by turning the wrench over prior to starting the next stroke.

Open-end wrenches have a tendency to slip off metal fasteners when they are being turned. The box-end wrench, shown below, overcomes this problem.



Unlike the open-end, the openings of a box-end wrench are made to fit over the corners or "points" of nuts and bolt heads. The size marked on each end of the wrench still refers to the distance between the flats of the metal fastener, however.

A box-end wrench has one fault...when there is limited turning space, it must be lifted off the nut or bolt at the end of each stroke. A combination wrench which has a box-end on one end and an open-end on the other overcomes this problem.

Combination wrenches are used as follows: First, the box-end is used to "break" loose the nut or bolt, then the ends are "swapped" and the open-end is used, because metal fasteners can be loosened (and tightened) faster with the open-end. Obviously, each end of a combination wrench will fit only one size nut or bolt.

To provide turning clearance over obstructions or other metal fasteners, box-end and combination wrenches are sometimes bent, or offset. The offset is similar to the slugging wrench offset below.

A single-ended, box-end wrench, called a "slugging" wrench, is sometimes used to loosen metal fasteners that hold the flanges of steam lines together. A slugging wrench has a pad on one end. It is the only wrench that is made to be struck with a hammer.



Here are three common-sense rules to follow when using a wrench...any kind of a wrench.

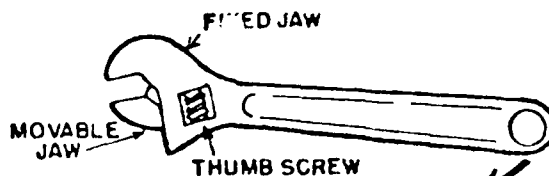
(1) Make sure the wrench fits the metal fastener. When the wrench is too large...does not fit snugly on the metal fastener...the wrench will slip and round off the corners of the bolt head or nut you are trying to loosen or tighten.

(2) PULL the wrench towards you...DON'T PUSH. When you push, and the wrench slips, or the metal fastener "breaks" loose, you can really skin up a good set of knuckles...YOURS! (NOTE: If pushing the wrench is the only way, do it with the open palm of your hand.)

(3) Don't use too much force! When a metal fastener doesn't turn easily, the threads may be damaged, rusted, corroded or mismatched (wrong series). Too much force can also s-t-r-e-t-c-h the threads of a stud or bolt or shear the head off a bolt! In either case, a simple job can suddenly turn into a real headache! (NOTE: Rusted or corroded metal fasteners can sometimes be freed by applying penetrating oil. Let the fasteners "soak" a bit, then try loosening with a wrench.)

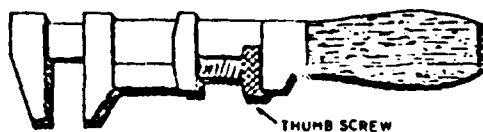
Different Types of Adjustable Wrenches

A useful tool, one which is all too often misused, is the adjustable, open-end wrench like the one shown below. NOTE: This tool is commonly called a "crescent" wrench. Here's how it works: By turning the thumbscrew, the size of the opening between the jaws can be changed to fit a wide range of sizes of metal fasteners and other fittings.



CAUTION: When using an adjustable open-end wrench, the thumbscrew must be adjusted to cause the jaws to fit snugly against the flats of the metal fastener. If this isn't done, the "play" between the thumbscrew and the moveable jaw may cause the wrench to slip...and round off the corners of bolts and nuts.

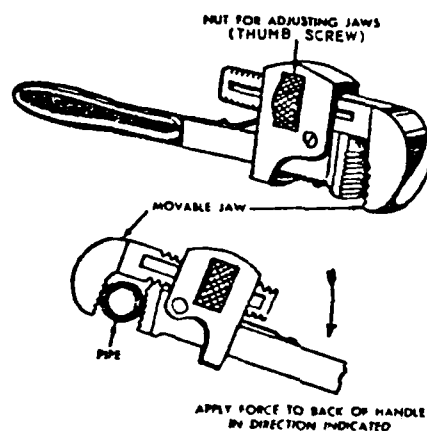
Another type of adjustable wrench, one with smooth jaws, is known as a "monkey" wrench. (It was invented by a guy named Monke.)



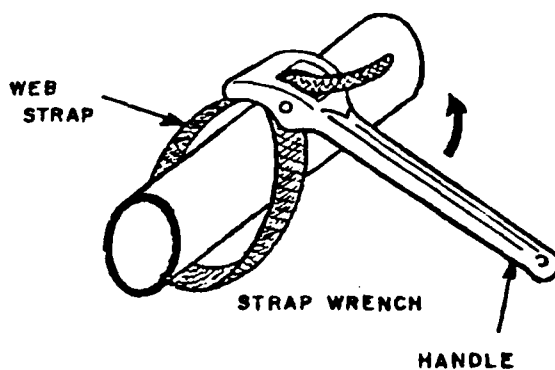
This wrench is preferred for use on large metal fasteners and fittings because the jaws are wider and stronger. A monkey wrench also fits a wider range of sizes than an adjustable open-end wrench of the same length.

An adjustable wrench that resembles a monkey wrench is the pipe wrench shown below. It has a fixed and a moveable jaw with teeth that bite into threaded iron pipe and pipe fittings. (This wrench may also be called a "Stillson.")

Never, never use a pipe wrench when the job calls for a wrench with smooth jaws! The teeth in the jaws of a pipe wrench will damage the surface of metal fasteners and fittings.



When it is necessary to turn a cylinder which has a smooth surface, such as the drive shaft of a pump, use a strap wrench like the one shown below.



The web strap is pulled through the opening in the handle until the strap fits snugly around the shaft. Pulling on the handle in the direction shown by the arrow will cause the strap to tighten, and increase the friction between the strap and the shaft. The shaft should turn.

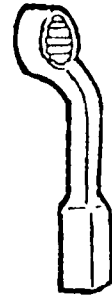
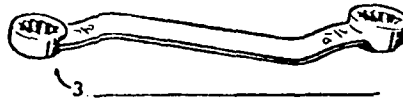
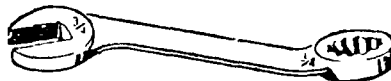
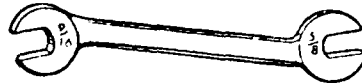
MODULE ONE
LESSON 2

HAND TOOLS

1. Using the List of Tools, write the name of each tool in the blank by the number of each diagram.

List of Tools

COMBINATION WRENCH
SLUGGING WRENCH
DOUBLE-ENDED BOX END WRENCH
DOUBLE-ENDED OPEN END WRENCH



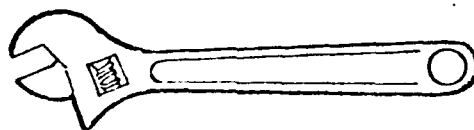
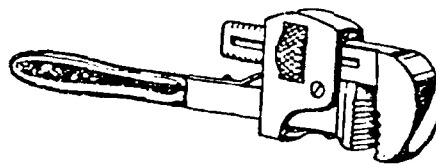
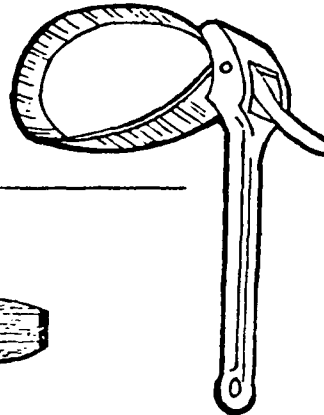
2. Using the diagrams above, write the number of the wrench best described by each statement, in the blank before each statement.

- _____ a. Each end fits over the "points" of a metal fastener.
- _____ b. Each end fits over the "flats" of a metal fastener.
- _____ c. Each end is made to fit one size of a metal fastener.
- _____ d. This wrench is made to be struck with a hammer.

3. Using the List of Tools, write the name of each wrench in the blank by the number of each diagram.

List of Tools

PIPE WRENCH
STRAP WRENCH
MONKEY WRENCH
ALLEN WRENCH
ADJUSTABLE, OPEN-END
WRENCH
COMBINATION WRENCH



YOUR COMMENTS

4. Using the diagrams on the opposite page, write the number of the tool or tools best described by each statement, in the blank before each statement

- ___ a. Its jaws have teeth for the purpose of biting into metal pipe.
- ___ b. The size of the jaw opening of these wrenches is adjusted by turning a thumb-screw or a thumb nut.
- ___ c. It is commonly known as a "crescent" wrench.
- ___ d. These wrenches have smooth jaws that fit on the flats of metal fasteners and fittings.
- ___ e. It is used to turn smooth cylinders or shafts without damaging their surfaces.

5. When using a wrench, you should always try to _____ the wrench _____ you.
(push/pull) (away from/toward)

6. When too much force is used to tighten threaded metal fasteners, the threads may be _____ and bolt heads may _____ off.

EXAMPLE 3. Adequacy Feedback

Instruction:

Narrative

One-2

NARRATIVE LESSON 2

HAND TOOLS

Introduction

When performing maintenance on machinery such as valves, pumps and steam turbines, operating engineers use wrenches, screwdrivers and pliers to remove and replace metal fasteners...the bolts, studs, nuts, and pins used to hold machinery together. As an engineer, you must have a knowledge of hand tools and their proper use because, without hand tools, maintenance of the machinery of an engineering propulsion plant is impossible. One mark of a professional operating engineer is his ability to select and use hand tools.

Different Types of Wrenches

The most common use for wrenches is to remove and replace nuts and bolts. In this lesson, you are going to learn about the following types of wrenches: open end, box end, combination, adjustable.

FEEDBACK

Orientation information should also tell the student what to study, and how he will be tested. As you will see, the instruction is topic oriented around each type wrench. A better way of presenting the material would be to list the wrenches with their pictures and functions. Then, a separate section should be presented on the general use of wrenches.

FEEDBACK

The open-end wrench picture is separated and identified. However, help for the STATEMENT is wordy and unclear. There is no clear statement about the wrench's function.

The box-end wrench picture is not identified and the STATEMENT about its function is buried at the end of a paragraph on open-end wrenches. It is performance oriented in that it tells you the wrench is hard to use when there is a limited turning space on the job.

The wrench shown below is a double-ended, open-end wrench. It is so-called because each end of the wrench has an open slot which is fitted onto the "flats" of a nut or bolt.



DISTANCE ACROSS
FLATS



As shown in the diagram above, the openings of a wrench may be at an angle with the handle. This makes the wrench easier to use when there is limited space to "swing" the wrench. When an obstruction limits the turning space, more "swing" can be obtained by turning the wrench over prior to starting the next stroke.

Open-end wrenches have a tendency to slip off metal fasteners when they are being turned. The box-end wrench, shown below, overcomes this problem.



Unlike the open-end, the openings of a box-end wrench are made to fit over the corners or "points" of nuts and bolt heads. The size marked on each end of the wrench still refers to the distance between the flats of the metal fastener, however.

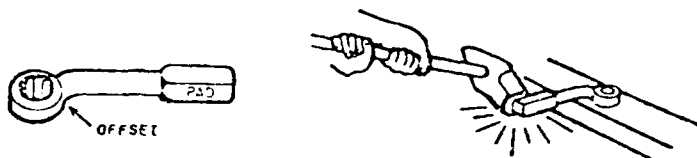
A box-end wrench has one fault...when there is limited turning space, it must be lifted off the nut or bolt at the end of each stroke. A combination wrench which has a box-end on one end and an open-end on the other overcomes this problem.

FEEDBACK

Combination wrenches are used as follows: First, the box-end is used to "break" loose the nut or bolt, then the ends are "swapped" and the open-end is used, because metal fasteners can be loosened (and tightened) faster with the open-end. Obviously, each end of a combination wrench will fit only one size nut or bolt.

To provide turning clearance over obstructions or other metal fasteners, box-end and combination wrenches are sometimes bent, or offset. The offset is similar to the slugging wrench offset below.

A single-ended, box-end wrench, called a "slugging" wrench, is sometimes used to loosen metal fasteners that hold the flanges of steam lines together. A slugging wrench has a pad on one end. It is the only wrench that is made to be struck with a hammer.



Here are three common-sense rules to follow when using a wrench...any kind of a wrench.

(1) Make sure the wrench fits the metal fastener. When the wrench is too large...does not fit snugly on the metal fastener...the wrench will slip and round off the corners of the bolt head or nut you are trying to loosen or tighten.

(2) PULL the wrench towards you...DON'T PUSH. When you push, and the wrench slips, or the metal fastener "breaks" loose, you can really skin up a good set of knuckles...YOURS! (NOTE: If pushing the wrench is the only way, do it with the open palm of your hand.)

Since the STATEMENT for the combination wrench is not consistent with the objective, its adequacy cannot be evaluated. However, it is obviously not separated or identified.

The STATEMENT for the slugging wrench is not separated and the picture is not identified. The function is located in the middle of the paragraph on the wrench.

At this point the descriptions about wrenches are interrupted by a STATEMENT on how to use a wrench. However, because not all the steps are included, it is not consistent. It is separated and identified, but not clearly stated. The third step contains more than one action.

FEEDBACK

There is a heading identifying this section as adjustable wrenches.

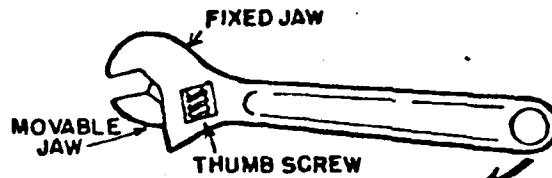
Here is the STATEMENT on the crescent wrench. It is not separated and the picture is not identified. In addition, there is a paragraph on how to use the wrench.

Again, the STATEMENT on the monkey wrench is not separated or the picture identified.

(3) Don't use too much force! When a metal fastener doesn't turn easily, the threads may be damaged, rusted, corroded or mismatched (wrong series). Too much force can also s-t-r-e-t-c-h the threads of a stud or bolt or shear the head off a bolt! In either case, a simple job can suddenly turn into a real headache! (NOTE: Rusty or corroded metal fasteners can sometimes be freed by applying penetrating oil. Let the fasteners "soak" a bit, then try loosening with a wrench.)

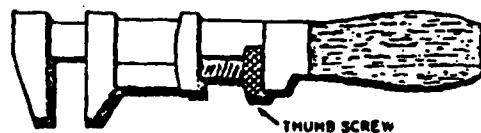
Different Types of Adjustable Wrenches

A useful tool, one which is all too often misused, is the adjustable, open-end wrench like the one shown below. NOTE: This tool is commonly called a "crescent" wrench. Here's how it works: By turning the thumbscrew, the size of the opening between the jaws can be changed to fit a wide range of sizes of metal fasteners and other fittings.



CAUTION: When using an adjustable open-end wrench, the thumbscrew must be adjusted to cause the jaws to fit snugly against the flats of the metal fastener. If this isn't done, the "play" between the thumbscrew and the moveable jaw may cause the wrench to slip...and round off the corners of bolts and nuts.

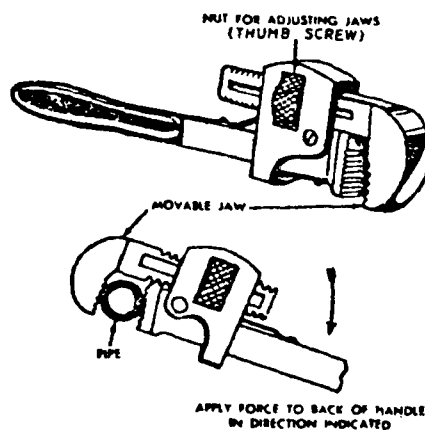
Another type of adjustable wrench, one with smooth jaws, is known as a "monkey" wrench. (It was invented by a guy named Monke.)



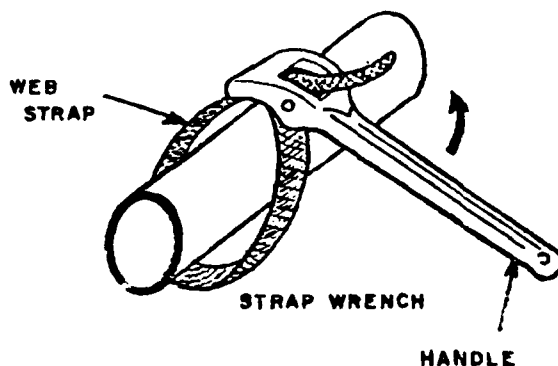
This wrench is preferred for use on large metal fasteners and fittings because the jaws are wider and stronger. A monkey wrench also fits a wider range of sizes than an adjustable open-end wrench of the same length.

An adjustable wrench that resembles a monkey wrench is the pipe wrench shown below. It has a fixed and a moveable jaw with teeth that bite into threaded iron pipe and pipe fittings. (This wrench may also be called a "Stillson.")

Never, never use a pipe wrench when the job calls for a wrench with smooth jaws! The teeth in the jaws of a pipe wrench will damage the surface of metal fasteners and fittings.



When it is necessary to turn a cylinder which has a smooth surface, such as the drive shaft of a pump, use a strap wrench like the one shown below.



The web strap is pulled through the opening in the handle until the strap fits snugly around the shaft. Pulling on the handle in the direction shown by the arrow will cause the strap to tighten, and increase the friction between the strap and the shaft. The shaft should turn.

The pipe or Stillson wrench picture is not identified.

The STATEMENT here is for the strap wrench and the picture is identified.

FEEDBACK

This is the beginning of the PRACTICE REMEMBERING section. In Item 1 the choice column (names) should include extra answers.

In item 2 the PRACTICE REMEMBERING is not consistent and cannot be evaluated for adequacy.

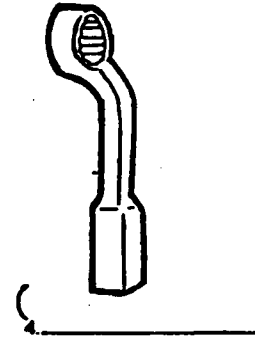
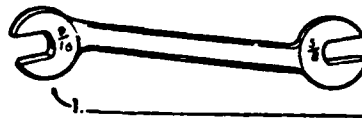
MODULE ONE LESSON 2

HAND TOOLS

- Using the List of Tools, write the name of each tool in the blank by the number of each diagram.

List of Tools

COMBINATION WRENCH
SLUGGING WRENCH
DOUBLE-ENDED BOX END WRENCH
DOUBLE-ENDED OPEN END WRENCH



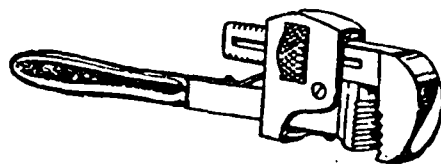
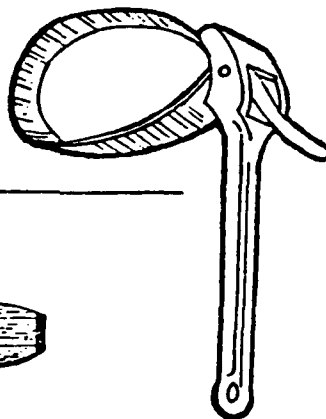
- Using the diagrams above, write the number of the wrench best described by each statement, in the blank before each statement.

- _____ a. Each end fits over the "points" of a metal fastener.
- _____ b. Each end fits over the "flats" of a metal fastener.
- _____ c. Each end is made to fit one size of a metal fastener.
- _____ d. This wrench is made to be struck with a hammer.

3. Using the List of Tools, write the name of each wrench in the blank by the number of each diagram.

List of Tools

PIPE WRENCH
STRAP WRENCH
MONKEY WRENCH
ALLEN WRENCH
ADJUSTABLE, OPEN-END
WRENCH
COMBINATION WRENCH



Item 3 is the rest of the PRACTICE REMEMBERING for objective 1 where the names and pictures need to be matched. Here the choice column has some extra answers which will be more like the test. However, the two items should be combined so that they are more like the test item will be.

FEEDBACK

Item 4 is a mish mash of PRACTICE REMEMBERING for all the objectives. It cannot be judged for adequacy.

Items 5 and 6 are to be PRACTICE REMEMBERING, but are inconsistent, so cannot be judged for adequacy.

4. Using the diagrams on the opposite page, write the number of the tool or tools best described by each statement, in the blank before each statement.

- ___ a. Its jaws have teeth for the purpose of biting into metal pipe.
- ___ b. The size of the jaw opening of these wrenches is adjusted by turning a thumb-screw or a thumb nut.
- ___ c. It is commonly known as a "crescent" wrench.
- ___ d. These wrenches have smooth jaws that fit on the flats of metal fasteners and fittings.
- ___ e. It is used to turn smooth cylinders or shafts without damaging their surfaces.

5. When using a wrench, you should always try to _____ the wrench _____ you.
(push/pull) (away from/toward)

6. When too much force is used to tighten threaded metal fasteners, the threads may be _____ and bolt heads may _____ off.

Adequacy Summary:

None of the STATEMENTS about the functions of the wrenches are separated or identified. Most of the pictures are not labeled.

The presentation is too wordy. There is not enough performance orientation: No instructions are given to the student about what to study for the test.

The PRACTICE REMEMBERING is inconsistent, and therefore inadequate.

Since we cannot review the feedback, there is no way of telling if it includes help or additional explanation.

REVISED VERSION OF EXAMPLE 1.

First aid for snakebite with severe symptoms

The victim of a snakebite must have prompt medical attention so he won't be disabled. The most important step is:

GET TO THE HOSPITAL QUICKLY

Meanwhile, apply the following procedure as first aid if the victim has severe reactions.

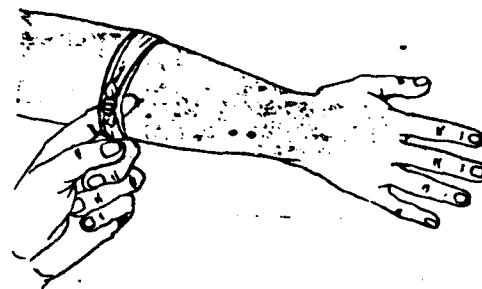
You will be tested on two things: First, you will have to remember the first aid steps and write them on a test. Second, you will perform the first aid on a "victim" while your instructor checks you. He will determine if you have followed the steps correctly.

FIRST AID for SNAKEBITE:

1. Have the victim lie down and keep calm.
2. Immobilize the bitten limb below heart level.

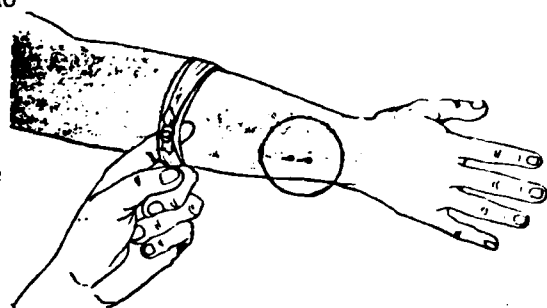
Constricting
Band

3. Choose a constricting band that is $3/4$ to $1\ 1/2$ inches wide, not thin like a rubber band.
4. Apply the constricting band 2 to 4 inches above the bite, closer to the heart. It should be snug but loose enough for a finger to be slipped underneath.
5. Do not apply around a joint - elbow, knee, wrist, or ankle - and not around the head, neck or trunk.
6. Loosen the band if swelling occurs, but do not remove it.



Incision

7. Sterilize a sharp knife.
8. Make 1/2 inch long cuts no deeper than just through the skin, extending over the fang marks and the suspected venom deposit point. Cuts should be made lengthwise along the limb.
9. DO NOT MAKE CROSS-CUT INCISIONS. Do not make cuts on the head, neck or trunk.



Suction

10. Periodically check the pulse in the limb beyond the bite to be sure blood flow has not stopped.
11. Apply suction for 30 minutes with a cup or your mouth.
12. Go to the hospital for further treatment.

Test yourself:

On the test, you will write the steps from memory. Now, turn over the page and see if you can write each step. Check your answers with the steps listed above.

Example:

You will see a film demonstrating the first aid procedure for snakebite where the victim shows severe symptoms. Pay particular attention to the placement and width of the constricting band and its tightness. Watch where the incisions are made in relation to the fang marks and the depth and length of the incisions.

Practice:

Practice first aid on a "victim" simulating the incisions with a pen. Ask your instructor to check that you are doing each step correctly.

REVISED VERSION OF EXAMPLE 2.

Solve for capacitive reactance using the formula $X_C = \frac{1}{2\pi fC}$

In the fleet you will need to understand the relationships involved between capacitive reactance, frequency, capacitance, current and impedance. By solving for capacitive reactance (X_C) you will see for yourself how changes in frequency and capacitance effect reactance. This information is useful and necessary when you are troubleshooting some of the more difficult problems in electronics.

The theory of capacitive reactance is especially important for troubleshooting radar and communication equipment and other electronic systems having power and radio frequency circuits. X_C is very difficult to measure in the fleet, therefore it is always derived, using the basic formula given here.

The formula for calculating capacitive reactance reflects the inverse relationship of X_C to f and C .

$$X_C = \frac{1}{2\pi fC}$$

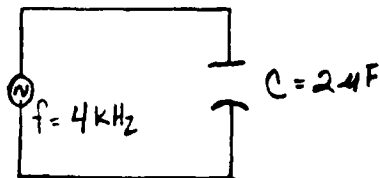
Where: X_C = capacitive reactance in ohms (Ω)

2π = 6.28 (a constant)

f = frequency in hertz (Hz)

C = capacitance in farads (F)

Example: Calculate X_C in the ac circuit shown.



Solution: $X_c = \frac{1}{2\pi fC}$

$$= \frac{1}{(6.28) fC}$$

$$= \frac{1}{(6.28) (4 \times 10^3) (2 \times 10^{-6})}$$

$$= \frac{1}{(6.28) (8 \times 10^{-3})}$$

OR

$$= \frac{1}{50.24 \times 10^{-3}}$$

$$= 0.0199 \times 10^3$$

$$= 19.9 \text{ ohms}$$

Substitute the constant for 2π :

Express the values for f and c in powers of ten and substitute them in the formula.

Do the multiplication in the denominator (bottom):

- (1) Multiply the significant digits and
- (2) add the exponents of powers of ten (e.g. 1. Subtract the smaller absolute value from the larger value.
2. Prefix the difference with the sign of the larger value.)

Do the division:

$$1) \text{ Find the reciprocal of } 50.24 \left(\frac{1}{50.24} = 0.0199 \right)$$

- 2) Move the power of ten to the numerator (just change the sign of the exponent).

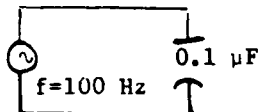
When the power of ten is positive, move the decimal to the right.

PRACTICE:

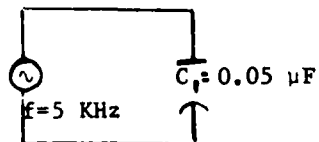
On the test you will have problems like those below, but in a multiple-choice format because of the CMI testing constraints. Use your calculator to solve for capacitive reactance correct to two decimals in the ac circuits given below.

$$(X_c = \frac{1}{2\pi fC})$$

The steps of the solutions are given on the next page.



Show your steps here:



Show your steps here:

On the test you will be asked to solve for capacitive reactance. You can use your calculator. The formula will be available, but you will have to read a schematic to find the values of frequency and capacitance.

SOLUTION for practice problem 1.

$$X_c = \frac{1}{2\pi fC}$$

$$= \frac{1}{(6.28)(1 \times 10^2)(1 \times 10^{-7})}$$

OR

Express the values for f and C in powers of ten and substitute them in the formula. (Notice that capacitance always has a negative exponent.)

$$= \frac{1}{6.28 \times 10^{-5}}$$

1. Multiply the significant digits.
2. Add the exponents of powers of ten.

$$= 0.159 \times 10^5$$

1. Find the reciprocal of 6.28 ($\frac{1}{6.28} = 0.159$)

2. Move the power often to the numerator by changing the sign of the exponent.

$$= 15.9 \times 10^3$$

Move the decimal to the right when the power of ten is positive.

$$X_c = 15.9 \text{ kilohms}$$

SOLUTION for practice problem 2.

$$X_c = \frac{1}{2\pi fC}$$

$$= \frac{1}{(6.28)(5 \times 10^3)(5 \times 10^{-8})}$$

$$= \frac{1}{157 \times 10^{-5}}$$

$$= 0.0063694 \times 10^5$$

$$= 636.94 \text{ ohms}$$

Express the values for f and C in powers of ten and substitute them in the formula.

1. Multiply the significant digits.
2. Add the exponents of powers of ten.
1. Find the reciprocal of 157 ($\frac{1}{157} = .006369$).
2. Move the power of ten to the numerator by changing the sign of the exponent.

Move the decimal to the right when the power of ten is positive.

REVISED VERSION OF EXAMPLE 3.

WRENCHES

Introduction:

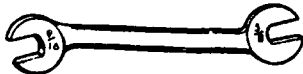
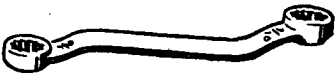


Wrenches are used to remove and replace metal fasteners. You must know about them because maintenance of machinery is impossible without them.

For later job performance you will need to be familiar with different types of wrenches. You must know their name, their appearance, their use and the procedures to use them. In later training or on the job, you will actually use the wrenches to perform jobs.

In this lesson you will be tested on three things. You will

1. Match the pictures of wrenches to their correct name.
2. Match the functions of wrenches to their correct name.
3. Write the steps of the procedure to use a wrench.

Pictures of the wrenches with their names and functions are listed. You should memorize them since you will be asked to match pictures and functions to wrench names in the test.

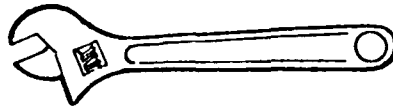
Wrench Name	Picture	Function
Open-end		To loosen or tighten one size of metal fasteners quickly.
Box-end		To loosen metal fasteners without the wrench slipping off the nut as easily as the open-end.
Combination		To "break" loose the nut or bolt with the box-end and then to loosen or tighten it quickly with the open-end.
Slugging		To loosen metal fasteners that hold the flanges of steam lines together. The only wrench made to be hit with a hammer.

Wrench Name

Picture

Function

Crescent



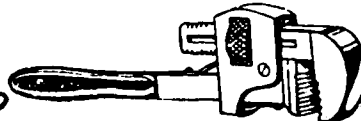
The jaw opening can be adjusted to fit a wider range of sizes of metal fasteners.

Monkey



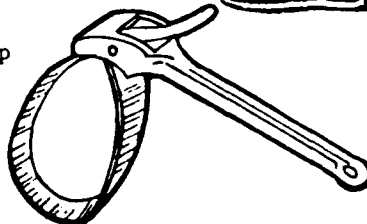
Has smooth jaws and is used on large metal fasteners.

Pipe or Stillson



Has teeth on jaws to "bite" into metal pipes.

Strap



To turn a cylinder which has a smooth surface such as the drive shaft of a pump.

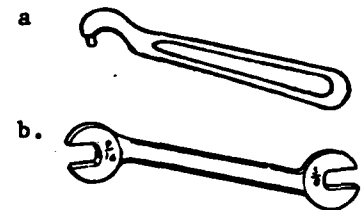
Practice:

Now test yourself to see how well you remember what each wrench looks like when you are given its name. Look at the name of each wrench in column A, then find the picture of it in column B and write its letter in column A.

Column A

- ___ 1. Box-end
- ___ 2. Slugging
- ___ 3. Crescent
- ___ 4. Open-end

Column B



- ___ 8. Stillson or pipe



Here is your chance to practice matching the use or function of a wrench to its name. Look at the name of each wrench in column A and match the use of the wrench in column B to its correct name.

Column A

____ 1. Slugging

____ 2. Monkey

____ 3. Crescent

____ 8. Open-end

Column B

a. Has teeth on jaws to bite into metal pipes.

b. To turn smooth surfaces like the drive shaft of a pump.

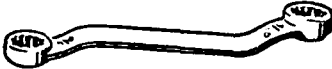

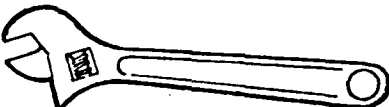

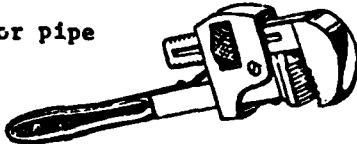
c. To loosen metal fasteners without the wrench slipping off easily.

j. To loosen metal fasteners that hold the flanges of steam lines together.

Check your answers on the next page.

Feedback:

Name and picture match.

<u>Answers</u>	<u>Name</u>	<u>Picture</u>	<u>Explanation</u>
<u>c</u>	1. Box-end		1. Notice the openings of the box-end wrench are made to <u>fit over</u> the corners of nuts and bolt heads.
<u>j</u>	2. Slugging		2. Notice the pad on one end of the wrench. It is the <u>only</u> wrench made to be hit with a hammer.
<u>e</u>	3. Crescent		3. Notice that this is like an open-end wrench, except the jaws can be adjusted using the thumbscrew to fit many sizes of fittings.
<u>f</u>	4. Open-end		4. Notice each end of wrench has an open slot to fit onto the "flats" of a nut or bolt.
<u>h</u>	8. Stillson or pipe		8. Notice the teeth on the pipe wrench. They will damage the surface of metal fasteners.

Feedback:

Name and function match.

<u>Answers</u>	<u>Name</u>	<u>Function</u>	<u>Explanation</u>
<u>1</u>	1. Slugging	To loosen metal fasteners that hold the flanges of steam lines together, smooth jaws.	1. <i>This is the only wrench designed to be hit with a hammer.</i>
<u> </u>	2. Monkey	To be used on large metal fasteners.	2. <i>This is the heavy duty version of the crescent wrench.</i>
<u> </u>	3. Crescent	Adjustable jaws to fit a wide range of metal fasteners.	3. <i>Smaller than the monkey wrench, yet adaptable to various size metal fasteners unlike an open-end wrench.</i>
<u> </u>	8. Open-end	Fits one size metal fastener, to loosen or tighten quickly.	8. <i>Sometimes tend to slip off metal fasteners when being turned.</i>

Here are some general rules to follow when using wrenches:

1. Keep clean and free from oil. Otherwise they may slip and injure you or damage the work.
2. Determine direction of turn to loosen nut.
3. Make sure wrench fits snugly against fastener or pipe.
4. Pull wrench towards you - don't push.
5. Use penetrating oil if it's hard to turn - don't force it.
6. Put away the wrench when the job's finished.

On the test you will have to write these steps from memory. Now practice remembering the steps by turning over the paper and writing them out. Turn back to this side and check your work.

CONCLUSION

This concludes Volume III of the IQI, the Training Workbook. This volume is intended to provide practice and additional examples of the application of the procedures in Volume IV.

Two points made in this volume must be reemphasized: First, the IQI is not a set of rigid procedures that must be meticulously followed in all situations. Instead, the IQI should be viewed as a set of guidelines designed to help the user ask appropriate questions about what is to be taught and how it should be taught.

Second, the most important thing to keep in mind while using the IQI is "REMEMBER THE JOB." All too often, users of procedures like this become lost in the procedural details, and forget about what they are trying to accomplish.

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